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G. B. Kneeland, Jr.

MANUAL OF DIAGNOSIS

OF

DISEASES OF THE HEART;

PRECEDED BY

CLINICAL RESEARCHES

FOR THE STUDY OF THESE AFFECTIONS.

BY

DOCTOR FELIX ANDRY,

EX-CHEF DE CLINIQUE AT THE HOSPITAL OF LA CHARITÉ.

TRANSLATED FROM THE FRENCH BY

SAMUEL KNEELAND, Jr., A. M., M. D.

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TO

. J. BOUILLAUD,

PROFESSOR OF CLINICAL MEDICINE TO THE MEDICAL FACULTY OF PARIS, MEMBER OF THE ROYAL ACADEMY OF MEDICINE, ETC., ETC.

Testimonial of Remembrance and Gratitude,

F. ANDRY.

AUTHOR'S PREFACE.

Much has, of late years, been written on the heart; but is this a good reason why the attention of physicians should no more be recalled to the subject? It would be a sufficient reason, if all the problems connected with this subject were solved; if all the questions were answered; if upon all the principal points in the physiological and clinical history of the heart, a universal consent replaced the difference of opinions, which has so long retarded the progress of science. But this is far from being the case; it may even be truly said, that few organs give rise to more numerous discussions and disagreements than the heart; for him who commences the study of these diseases, for him even who has devoted to them many years of research, there is doubt, hesitation between different systems, and very little faith as regards their diagnosis.

This skepticism, this incredulity, deserves the reproach of ignorance of the progress of medicine. We say it from conviction; and it is this firm conviction of the surety of our present means of exploration, and this desire to proclaim aloud what science can do

on this ground, where it can no longer be said that we grope in the dark, which have induced us to add this little work to those which have already appeared, from schools for the most part different, or opposite.

We say that among the last even, there are those who announce this deep conviction of the validity of their theories; this assurance, that to them alone belongs the thread of Ariadne, without which the clinical study of the heart is a veritable labyrinth. Between them and us, let the public judge; this question, we think, is well worthy of its attention.

Moreover, another cause has led to this work; the desire of simplifying, as much as possible, a study which is so often dry and repulsive; difficult in itself, and rendered still more so by a vicious system of observation.

This Manual is addressed, then, both to *physicians*, who will find in it a series of clinical observations, verified by post-mortem examination, which will prove to them to what degree of precision pretends the diagnosis of diseases of the heart; and to *students*, who, in this Manual of Diagnosis, will learn how those practical results are arrived at, which constitute the real victory of modern clinical observation.

TRANSLATOR'S PREFACE.

The intention and importance of this manual being fully set forth by the author in his preface, any apology on our part is unnecessary. Having felt the want, in the commencement of our medical studies, of a manual on diseases of the heart, at the same time concise and from good authority, we think that others may feel, or have felt a similar want. Concise this manual is, compared with the large works of Hope and Bouillaud, which the student has seldom the perseverance, or the practitioner the time, to study as they deserve. As it is compiled by a pupil of M. Bouillaud, in his wards, and, as it were, under his eye, it may be considered as a faithful and trustworthy account of the present opinions of the medical world, and especially of this eminent professor.

We hope that this manual will throw additional light on a most interesting part of medicine, especially as regards differential diagnosis; that it may refresh the memory of those who know, and serve as a guide to those who wish to learn.

S. K., Jr.

Boston, December 1, 1845.

CLINICAL RESEARCHES,

WITH A VIEW OF ASSISTING IN THE

DIAGNOSIS OF THE ORGANIC DISEASES OF THE HEART.

INTRODUCTORY CHAPTER.

Of all the diseases, the diagnosis of which has been perfected by the late progress of medicine, there are few which can be compared, in this respect, with the organic diseases of the circulatory system. Such is, at least, our conclusion, from a series of observations collected in the wards of Professor Bouillaud, during six consecutive years; either as a simple witness of the successful practice of this professor, or, during the last two years, as his "chef de clinique." We should think ourselves justified in asserting, that the diagnosis of these affections offers, in the majority of cases, a degree of precision almost mathematical, did we not fear, by this premature assertion, to present to some of our readers an appearance of exaggeration. Indeed, the differences of opinion among physicians, in regard to the theory of the normal sounds of the heart, have this unfortunate result, — that for many, the abnormal sounds (to which, as we shall see, the diagnosis owes its present certainty) are far from having the semeiological value which belongs to them; there are not a few, to whom all is mystery in this department of

medicine. One, whose talent for observation we are far from contesting, has said: "We cannot explain by the theory of M. Roannet, nor by any other, all the abnormal sounds of the heart, and thus arrive at the special diagnosis of the disease." [1]

We shall now submit this assertion to the test of facts; we shall see if, on the contrary, science does not possess means of exploration, by which lesions of the heart can be indicated, not only in a general manner, but often in their anatomical peculiarities; and if the most trustworthy and precise of these means is not auscultation, based upon the theory of M. Roannet, which, when examined in comparison with the pathological facts (if it can explain all), will thus receive a most incontestable proof.

After this first part, clinical, properly speaking, we shall examine succinctly our means of investigation themselves, which have led to our diagnosis in the different cases; we shall indicate their respective value in a manner that those who may wish to devote their attention to diseases of the heart, will find, as it were, a "Table of Diagnosis;" finally, we shall show the practical utility of these researches, and that far from having for their only result the satisfaction of a useless curiosity, they are susceptible of the most important practical applications.

We repeat, these are *clinical* researches which we present in this book; we shall here examine, with our readers, a series of facts, passing gradually from the simplest to the more complex, analyzing all with care, and borrowing from some wherewith to throw light upon others. Thus, while these facts give us all the light possible, by carefully noting the results of this examination, and collecting these scattered materials and successive acquisitions to our knowledge, we

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[1] Elemens de Pathologie generale, par M. le Professeur Chomel, Paris, 1841.

can easily supply any deficiency we may meet with; we shall thus embrace, at one view, both what science possesses, and what it is wanting in. This inventory (if the expression be allowable), this comparison of our riches with our poverty, will have, we trust, these advantages, — to show to certain observers that we are less poor than they suppose us; to others, what yet remains to be acquired; finally, to invite the particular attention, and direct the zeal, of all who desire to devote themselves to this important subject.

Such is, briefly, the object of this manual.

PART I.

Before commencing our clinical review, we think it necessary to establish, as briefly as possible, the theory which is to serve as our guide in the appreciation of the sounds of the heart. Here, more perhaps than in any other question, an exact knowledge of the normal state ought necessarily to precede the study of the diseased condition.

Four elements should be admitted, in our opinion, in the production of the sounds of the heart: first, the shock of the point of the organ against the walls of the chest; secondly, the sliding, one upon the other, of the two opposite surfaces of the pericardium; thirdly, the friction of the column of blood in the cavities of the heart; fourthly, the sudden closure of the valves, or the valvular flapping. Of these four elements, the last is the essential and predominant; but if the three others are generally masked by the last, if each of the first three is normally inaudible, it is none the less true, that in disease each may, in its turn, become predominant, and mask the others; this is proved by many examples, and should be borne in mind in appreciating the abnormal sounds.

Thus, first, the shock of the point of the heart, in our opinion, is habitually without any sensible sound; but in disease, we shall find this shock, by its exaggeration, producing, at one time, a dull heavy sound, peculiar, and easily distinguished from the other sounds; at another, a ringing sound,

(auriculo-metallic) of little value as a symptom, as we shall see hereafter, and compatible (to anticipate a little) with the healthy condition.

2dly. *The gliding of the serous surfaces of the pericardium.* As long as these two surfaces are lubricated, and perfectly smooth, no sound is produced by their motion; but let this smoothness be destroyed, let false membranes be formed on their opposite surfaces, and immediately there results a morbid sound, which can only be indicated here.

3dly. *Friction of the column of blood in the cavities of the heart.* The same observation will apply here. This friction, in the normal state, is the cause of no perceptible sound; the endocardium, a smooth membrane, presents no obstacle to the passage of the blood; but if this membrane be thickened, or rendered rough by vegetatious, or calcareous deposits; if the orifices be contracted, &c.; these new conditions, by increasing the friction of the current of blood, become so many powerful causes of morbid sounds. It is to this cause, that are owing all the sounds produced by any derangement of the fourth element, the *valvular closure;* all the lesions of the valves, whatever be their nature, produce an unnatural sound only in consequence of increased friction.

One word more upon this valvular flapping, in the normal state, and we shall have finished these preliminary remarks. The sounds of the heart are divided into two times, or distinct and successive sounds. What takes place during the first time? take the left side of the heart, for example: (what is said of this being equally applicable to the right side, whose movement is exactly synchronous.) During the first time, the left ventricle contracts, and throws the greater portion of its blood into the open aorta, while a small portion strikes against the bicuspid valve, and by its shock closes it, thus preventing all issue into the auricle. *It is this sudden closure of the bicuspid valve, which produces the first sound.*

M. Bouillaud [1] adds to this closure the meeting of the valves, which strike against each other, according to him, by their opposite surfaces. We confess we have never been able to perceive this, probably because we explain a little differently the mechanism of the valvular action. According to M. Bouillaud, the closure of the auriculo-ventricular valves is produced not only by the shock of the column of blood, but more especially by the action of the chordæ tendineæ, which end in the valves, thus answering the double purpose, 1st, of closing and stretching these movable membranes, by exercising a traction from their circumference towards the centre; and 2dly, of opposing, when once they are closed, their inversion, by the current of blood, towards the corresponding auricle. Of these two, the second has always appeared to us the principal. How, indeed, can it be supposed, that tendons, attached more or less perpendicularly to the ventricular surface of the valves, can, in contracting, bring these valves into a horizontal position? Is it not more natural to consider these tendinous chords as ingeniously contrived to give a solid support, and sufficient powers of resistance against the current of blood? If this theory be true, the tendinous apparatus should be strong in proportion to the force of the impulse which the valve has to sustain; which is, in fact, the case; for the bicuspid valve is furnished with two strong columnæ, and receives the insertions of about 25 tendons, the evident inferiority of the tendinous system of the tricuspid valve being in direct relation with the less powerful contractions of the right ventricle. Moreover, if a tendinous apparatus were necessary to the valvular closure, why were not the aortic and pulmonary valves furnished with one? Do not the arterial orifices require as exact a closure as the auriculo-ventricular? If the tendinous chords be considered as an apparatus of *resistance*, and not of *closure*, this absence

[1] Traite des maladies du cœur, 2 vols. Paris, 1840.

is easily explained, when we recollect how trifling is the systolic force of the aorta and pulmonary artery compared with that of the ventricles; and therefore how little likely are these valves to be inverted towards the ventricles. But this brings us to the second sound.

What, then, passes during the second time? The ventricle dilates, thereby causing a tendency of the blood to enter it; — but from two sources — 1st, from the auricle, where it meets with no opposition; for this "aspiration," exercised by the dilated ventricle, draws down the bicuspid valve, and the blood contained in the auricle enters freely the ventricular cavity — 2d, this "aspiration" of the ventricle acts upon the blood already passed into the aorta; a part of this blood returns then upon itself, in obedience to the aspiration of the ventricle, and the pressure exercised by the elastic wall of the aorta. But the return of this current immediately places an obstacle in its way, by the closure of the aortic valves, themselves drawn towards the ventricle. This sudden closure of the aortic valves is the cause of the second sound — *first sound*, then, caused by closure of the *bicuspid* valve; the *second*, by the closure of the *aortic*. It must be remarked, however, that, (more especially in disease,) when one valvular apparatus is closed, the open orifice of the other is traversed by a current of blood; (the aortic orifice at the first time, and the bicuspid orifice at the second;) and that this circumstance is so favorable to the production of a new sound, that if (in health even) it be slightly exaggerated, for instance, by the blood being driven too quickly through the orifice of the aorta, an additional sound may be heard at the first time; a light aortic souffle, which is often heard after running, or violent exertion; and which we have frequently noticed on the arrival of a patient at the hospital, disappearing after a few hours of rest. But it will be objected, if the rapidity of the current of blood is sufficient to produce a

souffle,[1] why is it *always* observed at the orifice of the *aorta*, and *never* at the *bicuspid* orifice? Why does it *always* exist at the *first* time, and *never* at the *second*? There are, we think, *two* reasons: the *first* is, that the blood ought necessarily to leave the heart quicker than it enters it, as the ventricular contraction (which expels it) is more powerful than the auricular contraction (which fills it), aided as is the last by the diastolic aspiration mentioned above; the *second* is the difference in the normal dimensions of the two orifices, the circumference of the aortic being only $2\frac{3}{4}$ inches, while that of the bicuspid is $4\frac{1}{8}$ inches. It may easily be supposed, that it would require a *less* contraction of the *aortic* orifice to produce a sensible effect.

It must also be remembered, that the first sound of the heart is normally slightly dull and prolonged, while the second is shorter and more clear; for in this difference itself, exists a new proof of the theory of M. Roannet. In fact, the first sound is dull, because the bicuspid and tricuspid valves have no surrounding body to propagate their vibrations but the fleshy walls of the heart itself; and moreover, because the chordæ tendineæ, stretched by the contraction of the carneæ columnæ and the closure of the valves, probably diminish and deaden their vibration. The clearness of the second sound results from the more favorable situation of the aortic and pulmonary valves for its propagation, being without chordæ tendineæ, and attached to tubes eminently elastic and vibratile.

This brings us to our clinical observations.

The number of organic affections of the heart which we have collected amounts to more than 60. Wishing to consider these diseases principally in a diagnostic point of view, we shall omit all those which have not been verified by a

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[1] Throughout the work, "souffle" is synonymous with *bellows sound.*

post-mortem examination — this reduces to about 20 the cases which we shall here analyze.

To proceed from simple to complex, we shall commence by a case of hypertrophy of the heart, without valvular lesion sufficiently marked to have been mentioned in the diagnosis. These cases are rare — as the valves are too essential parts of the heart, to permit any great degree of hypertrophy without participating in the lesion; and we shall presently see that the least deformity, the slightest thickening of these valves, should be indicated by sounds which will lead to the diagnosis.

First observation.—*Simple hypertrophy, without marked valvular lesion; œdema of the glottis.* A laborer, aged 44 years, was admitted to the Hospital of la Charité, the 26th of September, 1840; of a moderately strong constitution, and of a temperament rather lymphatic than sanguine. Twenty years before, while working in a quarry, he was injured by the falling of a mass of stones; and his chest, still a little projecting in front, and sensibly depressed behind, seems to bear the marks of this accident, which confined him four months at the Hospital St. Louis, where he was treated by 80 leeches to the right side, and 30 to the neck. Five years ago, he contracted what he calls a "cold," without being able to define more precisely the disease; for which he was treated, according to his own statement, by the application of 15 leeches to the præcordial region. Excepting at these two epochs, his health has been habitually good. At the present time, he complains of a little dyspnœa, which he has had for eight days; a slight cough, without expectoration; of headache with sense of heaviness; no loss of appetite, no fever, not even palpitations.

The following are the principal results of a careful examination. Digestive functions unaffected; heat of skin moderate; pulse 40 to 44, moderately developed, unequal, intermittent, irregular, the ordinary pulsation being sometimes

immediately succeeded by another smaller one; no prominence of the præcordial region, no abnormal dulness, no vibratory thrill. The sounds of the heart, presenting the same anomalies of rhythm as the pulse, are remarkable for their dry, parchment-like tone, but without the bellows sound (souffle); they may be heard even under the right clavicle. The cough is unfrequent, without expectoration; no pain in the chest; the respiration and resonance normal in front; also behind on the right side, except at the base of the chest, where a mucous râle is heard, extending over the whole left side, accompanied on the latter with slightly diminished resonance; slight headache and heaviness; a trifling œdema at the lower part of the right leg — the patient walked with ease to the hospital.

In presence of these symptoms, what should be the diagnosis? An acute lesion of the respiratory apparatus? This idea was little compatible with the slow pulse. Moreover, to anticipate, there was here an œdema of the lungs, an affection uncommon as an active disease, hitherto little studied, and of which the idea did not present itself to our mind.

M. Bouillaud, who the next morning repeated the examination, was in doubt on this subject; he prescribed nevertheless a venæsection of ℥xij, a pectoral ptisan,[1] a julep,[2] an emema, and diet. As regards the heart, what were we justified in admitting, after the symptoms just enumerated, unless a *moderate hypertrophy* without grave lesion of the

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[1] The epithet *pectoral* is applied to such flowers, fruits, &c. as are supposed to be efficacious in *pectoral* diseases — the flowers of the mallow, the violet, the roots of the marsh-mallow, the liquorice, the Iceland moss; and the dried fruits, as raisins, dates, figs, jujube. The pectoral ptisan is generally made by boiling, deprived of their stones, an ounce of the last, for about an hour, from 3 pints down to a quart.—*S. K.*

[2] A julep is simply distilled water rendered palatable by some syrup, for the drink of the patient.—*S. K.*

valves? And this hypertrophy we admitted with a certain reserve, deprived as we were, (perhaps from the accidental deformation of the chest,) of the ordinary physical signs, as increase of dulness, præcordial prominence, and displacement of the point of the heart; and having, as symptoms of the morbid condition, only the irregularities of the pulse, and the parchment-like character of the sounds, a character which we shall see always corresponding with a certain valvular thickening, rare without hypertrophy of the heart itself.

On the following days, the patient's condition was the same; the blood from the venæsection was natural. A plaster of Burgundy pitch with tartar emetic,[1] was applied to the back of the chest. The sthethoscopic phenomena persist; the pulse becomes more regular, but more tense, and a little vibrating; by degrees rising to 60 – 64. At the same time, the infiltration of the lower extremities slowly increases; the scrotum even is œdematous.

On the 16th of October, the patient complains more. Since the last evening, he has been seized with a severe sore throat; his voice guttural; deglutition painful; vivid redness of the fauces, with swelling of the uvula, but without swelling of the tonsils; countenance animated; heat of skin moderate; pulse 80, intermittent — 30 leeches to the neck were prescribed.

At the evening visit, he was seated on his bed, suffering from violent dyspnœa; the inspiration slightly whistling; on auscultation, nothing was heard but a râle, which seemed to proceed from the larynx; anxious expression of countenance; the skin hotter; the pulse 96 – 100. Although the leech bites still bled, we ordered a further bleeding of ℥xvj, and sinapisms to the feet. Notwithstanding these means, the dyspnœa continued, and the patient died at one, on the morning of the 17th.

Autopsy. The epiglottis is remarkable for a thickening,

[1] 10 to 20 grains spread upon the plaster of Burgundy pitch.

apparently œdematous, in which the surrounding parts were involved, especially the aryteno-epiglottic folds or ligaments; on incision there flowed out a yellowish pus, recently formed, and infiltrating the surrounding cellular tissue. The glottis is sensibly smaller than natural; the vocal chords swelled, œdematous, without any signs of suppuration; the laryngean ventricles were effaced; the mucous membrane of the larynx and trachea was pale. The lungs, sufficiently soft and crepitant, were slightly engorged at their posterior parts, and infiltrated with an abundant serosity.

The heart is remarkable for its size, the hypertrophy affecting chiefly the left ventricle — slight thickening of the bicuspid valve. The aortic valves had their normal thinness; only, each tubercle of Arantius was a little more developed and hard than natural. The whole extent of the endocardium, and the origin of the aorta and pulmonary artery were of a vivd red, disappearing but partially on washing.

This observation, which we thought sufficiently interesting to present with all its details, affords matter for numerous reflections, especially in reference to the œdema of the lungs; but our purpose is the diagnosis of the disease of the heart. Here the autopsy fully verifies the indications drawn from the symptoms — the signs during life were those of simple hypertrophy; they barely indicated a slight valvular thickening; the autopsy has confirmed the diagnosis; neither more nor less. As to the cause of the affection, there may be a doubt between an external violence, and an acute thoracic disease; the last being the most probable of the two.

Observation 2d.—*Lesion of the left auriculo-ventricular valve alone, without insufficiency.*[1] Laurence Bavaux, aged 39 years, domestic, entered our wards the 22d of Septem-

[1] By insufficiency is meant an *imperfect closure* of the valves, from any cause, so that they are insufficient, or incapable of preventing the regurgitation of the blood into the auricle at the first time, and into the ventricle at the second.—*S. K.*

ber, 1840. Ill for six months previously. She was affected with tubercles at the summit of both lungs, especially the right — after having observed this, we passed to the examination of the heart. The patient says she has not been subject to palpitations ; the pulse is slightly developed, but this is in accordance with the general emaciation ; the dulness of the præcordial region is normal ; no prominence, no vibratory thrill. What was our astonishment to hear, on applying the ear to the region of the heart, a rough, bellows sound, appearing at first to exist only at the second time ; but becoming more distinct as we approached the bicuspid valve, and, at this point, completely masking the two times ; not prolonged into the carotids, nor even into the aorta ! From these symptoms, we have no hesitation in pronouncing the existence of a *left auriculo-ventricular lesion alone*, accompanied by a slight hypertrophy of the heart, the affected valve, of course, being *insufficient.* We explain the *double* bellows sound by saying : the column of blood strikes against this thickened, swelled, incompletely moveable valve, 1st, when *a part of it*, from the ventricular systole, *regurgitates* through the *imperfectly closed* orifice into the auricle, whence the souffle of the *first time ;* 2dly, when the *whole* column of blood, under the influence of the auricular contraction, and especially the diastolic aspiration of the left ventricle, enters this ventricle by an *imperfectly-opened* orifice, whence the souffle of the *second* time ; and if the second souffle is more marked than the first, it is because the *former* is produced by the friction of the *whole column* of blood, while the *latter* is the result of the friction of a *part only.* From this difference in the intensity of the two souffles, it results that the first, the most feeble, ceases to be heard at a little distance from its origin, being masked by the flapping of the tricuspid valve ; while the second, the strongest, is heard even in the region where the flapping of the aortic and pulmonary valves might mask it. So that there is souffle at the *second time* over the *whole*

præcordial region, and souffle at *both times* in the *region of the diseased orifice only.*

A month after her entrance, the patient died of phthisis, and (to speak of that only which concerns us here) the following is what we found at the autopsy: the heart of normal size, a little large perhaps in relation to the emaciation of the subject and the tubercular affection; the right cavities distended by recent coagula; the tricuspid and pulmonary orifices perfectly sound; the aortic valves also sound and very thin; the *left auriculo-ventricular valve thickened, insufficient, forming a kind of fibro-cartilaginous ring.*

Is not a fact of this nature an unanswerable proof of the validity of our theory? Be it remarked here, that grave disorders of the heart may exist without sensible functional trouble, and, in a manner, without the knowledge of the patient.

Observation 3d. — *Lesion of the aortic valves, without insufficiency.* Anne Prudhomme, aged 70, washerwoman, entered the wards the 19th of May, 1841; of strong constitution, sanguine temperament, having had but two or three sicknesses in her life, which we think she does not know the nature of exactly, though she is certain she never had rheumatism or inflammation of the chest. For two months, she has been subject to headache, uneasiness, dyspnœa, palpitations, slight cough, and, for three weeks past, swelling of the lower extremities.

At her entrance, the circulating system was carefully examined, and the following symptoms were noticed: the pulse 68, moderately developed, regular; the præcordial region, concealed for the most part by the left breast, seemed to present neither prominence, abnormal dulness, nor vibratory thrill. The beating of the heart deep-seated, hardly perceptible to the hand; the two sounds, heard with difficulty from the patient's embonpoint, were distinct, the first, however, accompanied by a rough, prolonged souffle, having its

maximum of intensity in the region of the aortic orifice and ascending aorta, and extending into the carotids without any "bruit de diable."[1] The patient experienced palpitations from time to time, even in a state of repose; her sleep was often troubled by agitating dreams. The legs, especially the right, was the seat of an evident swelling, with tension, and slightly erysipelatous redness of the skin in the lower two thirds; no ascites.

Our diagnosis was, here, *moderate hypertrophy of the heart, with lesion of the aortic orifice in particular, without insufficiency of this orifice.*

To explain in a few words the reasons of this diagnosis. And first, *moderate hypertrophy of the heart — hypertrophy*, because there was *valvular lesion*, (as will be presently seen,) the *latter* almost always presupposing the *former;* and *moderate hypertrophy*, for there was neither *vibrating pulse*, *dulness*, *nor sensible beating;* lesion of the *aortic orifice*, and *souffle at the first time.* But what passes at the *first* time? The left ventricle contracts, and the column of blood escapes by the aortic orifice, without being accompanied by any other sound than the sudden closing of the bicuspid valve. We have here a *souffle* at the first time; what *lesion* does it indicate? An *excess of friction* of the blood against *one of the orifices* of the heart. *Which is this orifice?* Evidently, at the first time, it may *either be the bicuspid*

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[1] This expression cannot be well translated; it is a murmuring, slightly humming, continuous souffle, resembling the sound of this child's plaything. According to M. Bouillaud, its favorite seats are the carotid and subclavian arteries, having its maximum of intensity over the inner portion of the clavicle. It is generally explained by the friction of the column of blood, from the ventricular contraction, and the reaction of the arterial tubes — the *latter* will explain its occurrence during the *diastole* of the heart. It is almost always, (if not always,) connected with anæmia, or at least a condition of the blood, in which the serum predominates over the fibrine and coloring matter (hydremie); as in chlorosis, &c.—*S. K.*

incompletely closed, or the *aortic incompletely opened. How decide between the two?* By carefully examining to *what point corresponds the maximum of this souffle;* if the souffle is heard at its *maximum* towards the *base* of the heart, between the nipple and the sternum, if it is *prolonged into the ascending aorta*, and even into the *carotids*, it has its seat at the *aortic orifice.*

We have said lesion of the *aortic* orifice in particular; why this qualification, indicating the possibility of the lesion of *another orifice?* Strictly speaking, this complication is not impossible; the embonpoint of the patient did not permit the sounds to be analyzed with sufficient precision to affirm, on ausculting beyond the limits of the bicuspid region, that no souffle was mingled with the flapping of this valve; it might, then, be a question, whether a slight insufficiency of the *bicuspid* valve did not coexist with the lesion of the aorta.

Finally, *without insufficiency of the aortic valves.* Why so? because the *second* sound, the result of the closure of these valves, was complicated with *no souffle*, which would have been *inevitable*, if a part of the blood returned into the left ventricle by the *aortic opening insufficiently closed.*

This patient, whom repose and digitalis quickly restored to her habitual health, remained at the hospital, where she was employed as ward-tender. At the end of nine months, she was seized with a severe acute bronchitis, and died the 22d of February. During her stay at the hospital, she was ausculted from time to time, but the souffle at the first time offered no change of seat. The following was found at the autopsy: —

The heart enveloped in a thick covering of fat; this covering apart, its volume was not much larger than natural — still the auricles were dilated, and the left ventricle evidently hypertrophied; the walls of this ventricle were an inch thick at the base, the average normal thickness being three-

fifths of an inch. Water, poured into the aorta, remained at its proper level; still, the aortic valves, though sufficient and well-formed, were incrusted with a hard, bone-like matter, grating under the knife, and disposed in vertical lines. The internal surface of the aorta was smooth and polished; the left auriculo-ventricular orifice appeared normal. Its valve, dark red from cadaveric imbibition, was well-formed, slightly thickened, especially the part towards the aortic valves; it was, however, neither fibrous nor ossified; the valves of the right side were normal.

Is not this case exactly analogous to the preceding, both in the unity of the principal lesion, and the perfect correspondence between the diagnosis and the post-mortem appearances?

Observation 4th.—*Lesion of the aortic valves exclusively, with insufficiency.* A woman of thirty-six years, a seamstress, was received into the wards, the 11th of December, 1841, having an abdominal tumor of doubtful character, the history of which would lead us too far from our subject. To pass, then, to what is here of predominant interest, the examination of the heart, — in this, as in the second observation, there was nothing to lead to the anticipation of an affection of this organ; no previous diseases, as rheumatism, or inflammations of the chest; no palpitations, no dyspnœa. Nevertheless, a very distinct *double souffle* was heard in the *whole præcordial region*, but especially in the region of the *aorta and its orifice*, rather slight at the *first time*, rougher and more prolonged at the *second*, continued into the *carotids*, with "bruit de diable" on the right side. The præcordial region presented nothing else remarkable, though it was covered by a large breast; the pulse was remarkable for its smallness. The details of the last case being so full, we need not explain at length the diagnosis of this. It is easy to see, — first, that, from the *seat of the souffle*, there is lesion of the *aortic* valves; second, from its existence at the

second time, that this lesion is accompanied with their *insufficiency*. Is there also considerable hypertrophy ? probably not ; nothing would lead to this supposition. Our diagnosis was, then ; — *medium hypertrophy of the heart, thickening and deformation of the aortic valves, whence their insufficiency ; without notable deformation of the bicuspid valve ;* such are the exact terms of the diagnosis, copied from notes taken at the time.

The following lesions were found at the autopsy, which were took place nine days after the patient's entrance. The heart is quite large, but it presents externally a considerable quantity of fat, and, in its interior, blackish, soft, unorganized concretions ; freed from these coagula, and washed, it weighed about 11 ounces (avoirdupois), the normal weight being between 8 and 9. The left ventricle was almost exclusively the seat of this hypertrophy ; its walls, at the base of the heart, were four-fifths of an inch thick, — though the columnæ carneæ were not proportionably developed. Before opening this ventricle,[1] water was poured into the aorta, and penetrated immediately into the ventricular cavity ; the aortic valves were thickened, almost fibrous, (especially at their free edge, which was swollen,) but without adherence to each other, and slightly contracted. The circumference of this orifice was $2\frac{3}{4}$ inches ; above the valves, the internal face of the aorta presented some rough incrustations, of a deep yellow color, the commencement of an ossific deposit. The bicuspid valve was well-formed, very slightly thickened, or rather presenting partial swellings, under the form of small, reddish points ; the circumference of the orifice rather less than usual, $3\frac{1}{2}$ inches ; the auricle offered nothing re-

[1] M. Bouillaud advises the heart to be opened, *each cavity separately*, with scissors, on its *anterior surface*, and in a direction *parallel to the principal axis of each cavity :* many abnormal conditions will thus be detected, which would otherwise escape notice.— *S. K.*

markable. The right side of the heart was perfectly normal; the circumference of the pulmonary orifice being three inches, that of the tricuspid being four inches.

The perfect correspondence between the diagnosis and the autopsy is evident; we would only mention the rough incrustations on the internal surface of the aorta, which were a cause of *friction*, and consequently of *souffle*, to be added to the condition of the aortic valves. The little reddish points, disseminated on the border of the bicuspid valve, deserve some notice; we do not hesitate to consider them as so many fibrinous concretions, which had become adherent, enjoying a life as it were parasitical, and which would have been, at a later period, as many centres for the formation of cartilage or bone, similar to those often found on the valves, when advanced to a certain degree of deformation. The localization of the disease in the left side of the heart should also be noticed. As to the orifices of the heart, all strictly conformed to the measures of the normal circumference established by M. Bouillaud.

Observation 5th.—*Lesion of the aortic valves especially, with a cretaceous state of the aorta.* A teamster, aged 45, of very strong constitution, and sanguine temperament, was admitted to the hospital the 27th of December, 1841. The only important circumstance in his anterior life was, that in 1819, at which time he had served eight years in the cavalry, he received a kick from a horse, in the anterior external region of the left lower ribs, which obliged him to enter the hospital of Gros-Caillou. Treated by two or three applications of leeches, and cupping-glasses, he went out at the end of two months, wishing to enter the service again; but was unable to support the shocks of riding, being still subject to palpitations and dyspnœa, for which he was dismissed by Baron Larrey. Since that time, his health has been generally good, except in 1821, when he was attacked by a disease which he cannot well describe, but which was evi-

dently neither an inflammation of the chest nor rheumatism. Since 1821, as before, his employment has been laborious and difficult, which often gave rise, for a time, to violent palpitations and dyspnœa. For these he had now come to the hospital. Fifteen days ago, to these symptoms was added a considerable infiltration of the upper and lower extremities, genital organs, and even the face.

Present state. — The face still presents some traces of swelling; no ascites; infiltration of the lower extremities. The pulse is 68, vibrating, strong, resistant, "hypertrophic," if the expression be allowable. Præcordial region prominent; a difference of two degrees was marked by the cyrtometer.[1] The point of the heart feebly raises the sixth intercostal space, a little outside the nipple; it beats over a sufficient space, but deeply, without vibratory thrill at present. The dulness on percussion is 3 inches vertically, and $3\frac{1}{2}$ transversely; in the whole extent of the præcordial region, a double souffle completely replaces the flapping of the two valves. Towards the bicuspid orifice, the two souffles are short; the first accompanied by a dull sound, occasioned by the shock of the point of the heart. As you approach the aortic orifice, the two souffles become more distinct, that of the second time being the most strongly marked; both are rough, rasping, very distinct in the whole course of the ascending aorta, and even below the clavicles, without valvular flapping in any part of the chest. The subclavian and carotid arteries beat strongly, the double souffle being also propagated to them; there is souffle also, but single and upon pressure only, in the abdominal aorta and crural arteries; evident dilatation of the jugular veins. Nothing remarkable in the respiratory apparatus, except a fine, mucous râle, at the inferior and posterior portion of the left lung.

[1] A complicated instrument, for measuring præcordial prominence.

Such were the symptoms noticed at his entrance, and confirmed the next morning by M. Bouillaud, who added to the diagnosis, "very slight vibratory thrill in the carotids and subclavians."

Our diagnosis was, — *Considerable hypertrophy of the heart* (16 to 18 ounces). *Thickening and deformation of the left valves, with insufficiency of the aortic. Hypertrophy and cretaceous state of the aorta, and arteries in general.*

Let us carefully explain the reasons of this diagnosis.

Considerable hypertrophy of the heart. Pulse vibrating; præcordial prominence; displacement of the apex of the heart; beating over an extensive surface; increased dul ness.

Weight of the heart 16 *to* 18 *ounces.* The average weight of the heart is between 8 and 9 ounces. We have here præcordial dulness, for at least double the normal extent; we are then justified in supposing the weight of the heart at least double its normal weight. These calculations are not mathematically exact; especially when the heart's weight surpasses the ordinary limits of hypertrophy, as in this patient. In these cases, in estimating the weight of the heart, it should be understood that it at least *equals* the above amount, but not that it does not *surpass* it.

Thickening and deformation of the left valves. No valvular flapping; the valves are, then, not only thickened, which is always the first lesion, but changed in form.

We have said, "of the valves;" *why of both?* Because no *flapping sound* is heard at *either time;* because, in its stead, there is a *double souffle.* Be it understood, however, that two souffles do not always indicate the lesion of two valves; the same orifice, if insufficient, being able to cause a souffle at both times. But the normal flapping of the other orifice may be masked by the souffle of the first, if it be ever so little pronounced; if it is, on the one hand, however, the nature of a *souffle to be more noisy than a valvular*

flapping, it is equally natural that the *former should be propagated to a less extent than the latter.* If, then, *in its neighborhood, the souffle masks the flapping*, withdraw the ear beyond the point of departure of the two sounds, *auscult above the præcordial region*, (sometimes it is necessary to rise to even under the right clavicle); *then* the valvular sound becomes perceptible, because the souffle has ceased to be heard; and when the precise time of this flapping is determined, the integrity of the corresponding valve may be confidently asserted. Still, there are cases in which this precaution, this verification of the præcordial auscultation by auscultation more or less distant, leaves us at fault. These are when there is coincidence of valvular lesion of the right side of the heart, and consequently of a new souffle, with normal valvular flapping. It may happen that this new souffle, being added to the souffle of the left orifice, may be prolonged with it to such a distance, as not to permit, or only at rare intervals, the emerging of the normal sound of the valve; this coincidence, in fact, existed in the present case. We shall see, at the autopsy, that there was an insufficiency of the tricuspid valve, a cause of souffle at the first time, added to that furnished by the aortic orifice; and that these two souffles together might well completely mask the supposed normal flapping of the bicuspid valve. We say *supposed*, because nothing as yet justifies us in admitting the integrity of this valve; but this restriction may be suppressed, when it is added, that during the stay of the patient at the hospital, a normal flapping was heard, at intervals, at the first time. This particularity was noticed, for the first time, the 25th of February, in the following, dictated at the morning visit: — "Same sounds as on the first day; the first sound of the heart may be heard in the lateral parts of the neck, and the neighborhood." It may, perhaps, seem strange that a souffle, an effect of a constant, organic cause, should thus vary in intensity; it is a clinical fact of every day's

observation, the reasons of which will be given when treating of stethoscopic signs.

We have thus, at some length, displayed the semeiological valve of this double souffle, and habitual absence of valvular flapping; before quitting the subject, it may be well to answer a natural objection. A double souffle, it has been said, does not indicate two diseased orifices, unless it is double wherever it is heard; if it has for its seat a single orifice, there will be a point to the outside of, and more or less distant from the præcordial region, where the normal flapping will be heard. Well, then, it is objected, ought not this to be the case always, whether the lesion of the left side of the heart be single or double? For if the normal flapping be not produced by either of the *left*, can it not be by *one*, *or both of the right valves?* How distinguish the two cases? We confess this difficulty might present itself, and be a possible cause of error in certain cases; but if it is not impossible, it is, at least, not frequent, as these clinical studies will show. This infrequency seems to be because the normal sounds of the right side of the heart are doubtless less strongly marked than those of the left, from the relative difference in the force of contraction of the two ventricles, both in health and disease; if this be true, it may easily be conceived that these sounds are not sufficiently loud to extend beyond the sphere of the souffles of the left side of the heart.

To return to our diagnosis. — *Insufficiency of the aortic valves;* and why? For this double reason, that the maximum of the souffle answers to the second time, and to the region of the aortic orifice.

Finally, *cretaceous state and hypertrophy of the aorta, and arteries in general.* The vibration of the pulse, the strong pulsations of the subclavians and carotids, with their vibratory thrill, leave no room to doubt the hypertrophy of these vessels. As to the cretaceous state of the aorta, we were led to suppose it from the intensity and roughness of

the souffle in the aortic region, too intense to be due solely to valvular insufficiency, the importance of which was somewhat diminished by the development of the radial pulsations.

This patient, after alternate momentary relief, and paroxysms of dyspnœa, was attacked, in the month of February, with an almost total œdema of the inferior extremities, complicated with erysipelas, and albuminous urine, and died on the 2d of March.

Autopsy. — The heart enormously hypertrophied ; freed from coagula and washed, it weighed, with the origin of the large vessels, 25 ounces.

Right cavities. — The right side participated in the hypertrophy, which, however, more especially affected the left. The substance of the right ventricle was firm, and the columnæ well developed. The pulmonary artery was $3\frac{3}{4}$ inches in circumference at its orifice, instead of $2\frac{3}{4}$; its valves, otherwise sound and well formed, were three-fourths of an inch deep, instead of about half an inch. The auricle was sensibly dilated ; the circumference of its orifice being about 6 inches, instead of about $4\frac{1}{3}$. Its valve was thin, well formed, but not in proportion, as to volume, to the increased size of the orifice it should close ; for its maximum depth was hardly an inch, that is about two lines more than its normal depth ; but the excess of the circumference of the orifice being about an inch and two-thirds, and the normal proportion between the depth of the valve and the orifice being as one to five, it is evident that an excess represented by 20 lines, *on the side of the orifice*, would require, on the side of the valve, an excess represented by 4 lines instead of 2. The valve was, then, insufficient, by a quantity represented by 2 lines.[1]

Left cavities. — Water poured into the aorta appeared not to flow into the ventricle, or at least very slowly — indeed,

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[1] These calculations are not mathematically strict, but only approximative.—*S. K.*

the aortic valves, thickened, hypertrophied, even slightly fibrous, did not appear insufficient. The circumference of the aortic orifice was $4\frac{1}{5}$ inches, (instead of $2\frac{3}{4}$) ; but the valves were increased in proportion — their depth was about $\frac{3}{4}$, instead of $\frac{1}{2}$ an inch. In the substance of the parietes separating these valves from the pulmonary, there was a chalky deposit, about twice the size of a cherry-stone, and difficult to remove from its bed ; adhering to the aortic valve the nearest to the pulmonary artery, so as to leave, after its detachment, a slight excavation. On the internal face of the aorta, were seen several rugosities, and two small irregular ulcerations, 2 or 3 lines in diameter — in the thoracic aorta were three small prominent spots of a yellowish color. The left auricle was less dilated than the right. The bicuspid valve sound, perhaps slightly swelled at its free edge — a portion of this orifice having been divided, it could not be measured ; but the valve was evidently sufficient, as its depth varied between 9 and 13 lines. The left ventricle essentially hypertrophied ; the thickness of its walls, from the base nearly to its apex, being an inch.

The large arteries, especially the carotids and the crurals, were hypertrophied ; their parietes, without being ossified, were firmer and more resisting than usual.

It is easy to perceive between the autopsy and the diagnosis an almost complete agreement ; still, there are *two points*, we confess it frankly, of disagreement. First, the weight of the heart greatly *exceeded* our estimate ; as regards this, we refer to what is said above on the weight of the heart, in the diagnosis. A more important point, is the little probability, or the trifling amount of *insufficiency in the aortic valves*, indicated, nevertheless, by a rough, loud souffle, evidently more marked at the second time than at the first. In confessing our error, be it remembered that we had suspected a cretaceous state of the aorta ; this souffle was not, then, due to aortic insufficiency. This error is of utility, as it furnishes,

for the first time, an element, which will serve to complete what has been said on the subject of souffles at the second time. It shows that these *souffles in the aortic region* may be owing not only, as most generally, to the *reflux of the blood into the ventricle*, but, also, to the *friction of the current, during its retrograde shock, against the inequalities with which the aorta may be covered;* which last was the case with the present patient. It is unnecessary to add, that this friction may equally well take place at the *first time.*

This is sufficiently important, in a clinical point of view, not to be passed over, without being impressed upon the memory by new facts, as precise as possible. In the following three observations, therefore, the cretaceous state of the aorta will be seen indicated : 1*st*, *by a souffle at the second time, as in the present case;* 2*d*, *by a souffle at the first time;* 3*d*, *by a double souffle.*

Observation 6th. — *Souffle at the second time especially, from cretaceous state of the aorta.* Francis Laforge, aged 65 years, day laborer, was received into the hospital, the 28th of February, 1842. At his entrance he complained only of acute pain in the epigastrium, of three or four days' duration, consequent on swallowing a small portion of aqua fortis by mistake. We omit designedly the details of this accident, the consequences of which caused his death at the end of a month, in order to enter at once upon what here concerns us. Questioned as to his former life, he said he was only affected, fifteen years ago, with an inflammation of the right side of the chest — since then, although his health has been good, he has been subject to palpitations. On examining the heart, we were at first struck with the evident displacement of the apex; the finger easily felt it at the sixth intercostal space, a little to the outside of the nipple — no præcordial prominence; no vibratory thrill; no remarkable increase in the extent of dulness. As to the sounds, which were slightly unequal, and less clearly marked than usual, there was no

perceptible souffle in the præcordial region properly so called; but in the region of the ascending aorta, a very distinct souffle replaced the second time, rough, increasing in intensity towards the upper part of the chest — completely above the sternum, the second time was accompanied by a slight souffle. The pulse, not febrile, was intermittent every five or six pulsations; it was little developed, considering the strong constitution of the patient, but hard and vibrating.

With these symptoms, what should be the diagnosis?

In the first place, there was *evident hypertrophy;* the displacement of the point of the heart to the outside, and in the sixth intercostal space, is a sign almost pathognomonic. Was the hypertrophy considerable? We think not; in absence of such signs as præcordial prominence, increased dulness, &c. — we say, then, *moderate hypertrophy* of the heart.

The sounds were unequal, less clear than usual, but without souffle in the præcordial region; both were here distinctly heard. So far we are justified in saying: *the valves are affected, but their play is free;* they are, neither of them, *sensibly insufficient.* But in the *aortic region*, there are *two souffles*, one existing especially at the *second time* — this consideration changed a little our opinion, and we said, *insufficiency of the aortic valves.* We added, *cretaceous state of the aorta;* and many a time, reverting to this case with the pupils who then followed the evening visit, we insisted upon this condition of the aorta as the predominating lesion, showing them, in support of this opinion, that the *maximum* of souffle positively corresponded to the *aortic region;* but at the same time thinking that insufficiency of the valves contributed also to its production. But if aortic insufficiency existed here, to any considerable extent, why was not the souffle more distinct in the region of the aortic orifice itself? Why could it not be perceived at this point at the first time? Why was it only completely above the sternum, that this first time was accompanied with a slight souffle? These questions would

not have arisen, had we admitted the cretaceous state of the aorta as the only essential cause of the souffle. But it is asked, if the souffle of the second time has not for its chief cause the reflux of the blood into the ventricle, why this feeble development of the pulse, in relation neither with the patient's constitution, nor the vibration of the radial pulsations? This peculiarity would be explained by an aneurysmal dilatation of the arch of the aorta; which dilatation here existed; but our supposed aortic insufficiency precluded the necessity of this explanation.

To proceed to the *autopsy*, which took place the 31st of March, 1842. The heart sensibly more voluminous than usual; freed from coagula and washed, it weighed, with the origin of the large vessels, 16 ounces.

Right cavities. — The right ventricle was not dilated; on the contrary, it seemed relatively diminished in size; the maximum thickness of its walls at the base hardly two-fifths of an inch. The auricle was slightly enlarged, the auriculo-ventricular orifice being 5 inches in circumference; its valve a little thickened. Nothing remarkable in the pulmonary artery; its orifice being $3\frac{2}{5}$ inches in circumference.

Left cavities. — The left ventricle was the essential seat of the hypertrophy; towards the base, its walls were an inch in thickness (about 5 lines more than usual). The auricle not sensibly increased; its valve thickened, swelled in many points, presented a transverse diameter of about 4 inches. The aorta was remarkable for the volume of its arch, being about double the normal size. Water poured into this vessel penetrated but slowly into the ventricle; in fact, the valves, though thickened, and almost fibrous at their free edge, were well formed, and free in their play. The circumference of the orifice closed by them $3\frac{1}{2}$ inches; that of the arch, at the commencement of its curve, 5 inches. Between these two points, and also in almost the whole length of the descending aorta, the vessel was evidently hypertrophied, firm, thickened,

and incrusted on its internal surface with cretaceous plates, so close together at its origin, that no space could be distinguished between them; unless at this point, some slight solutions of continuity, which had the appearance of veritable ulcerations of the internal membrane. The heart and large vessels contained some fibrinous concretions, formed partly before death.

To compare our diagnosis with the autopsy. We said: moderate hypertrophy; we confess that 16 ounces is more than is indicated by this expression. But it is rare that this degree of hypertrophy is accompanied by so few symptoms; it is, therefore, an exceptional fact worthy of notice.

There can be no doubt, after the details upon the lesions of the aorta, and the aortic valves, that the souffle depended chiefly, if not wholly, upon the first of these causes. As has been remarked above, from an anticipation confirmed by the autopsy, by referring it to this cause, there remains no serious difficulty to be explained. It is easily understood, why the seat of the souffle did not correspond to the orifice of the aorta, but to its arch; why the radial pulsations were so feeble, the contractile power of the hypertrophied left ventricle being in part neutralized by the aneurysmal dilatation of the aorta. Still two things should be noticed. Why was the souffle stronger at the second time, than at the first? and why were the præcordial sounds free from souffle, the left valves being affected? To the first question it can only be answered by an hypothesis, that is, by supposing the aortic incrustations to be so directed (a configuration which we did not notice, it is true, but which is far from impossible) that the friction of the current of blood was greater, when it retrograded, than when it flowed from the ventricle. To the second question the answer will be more exact, and resting upon clinical experience. Every valvular lesion does not necessarily produce a souffle; as has been said above, the morbid sound supposes an excess of friction, as from con-

traction, for instance, of an orifice. It has been seen, that here the orifices were well formed; the valves, though thickened and almost fibrous, were free in their play; consequently, they did not oppose the passage of the blood. But it will be said, ought valves, thus thickened, to give a normal flapping? It will be recollected, that from the first day, we noticed, in the præcordial region, the sounds unequal, and less clearly marked than normally. Still the thickening of the valves, when it does not cause a souffle, is generally indicated by a peculiar modification, the parchment-like sound, which will be found, for the first time, in the following observation; but this shade of sound seems to us to require, for its production, a precise degree of thickening, impossible to determine exactly, but beyond which the sounds gradually lose their clearness, till, by a kind of transition, there is complete absence of flapping, and the production of new sounds.

The observation, which follows, offers a striking analogy to the preceding two; but independently of the importance of the diagnostic sign here spoken of, it offers another kind of interest.[1]

Observation 7th. — *Souffle at the first time especially, from cretaceous state of the ascending aorta, and neighboring large vessels.* George Thomas, 48 years, locksmith, was received into the hospital the 13th of April, 1837. Without having had any important disease to which the symptoms could be referred, he complained of having, since two months, palpitations, difficulty of breathing on the least exercise, syncope or dizziness, and intense headache.

Condition at the morning visit of the 14th. — Evident prominence at the upper and inner part of the left breast, slightly prolonged towards the upper part of the sternum;

[1] As this case was observed by M. Bouillaud, the author here takes the opportunity of making a slight eulogium; as this has nothing to do with *physical affections* of the heart, we shall not translate it.

no vibratory thrill; præcordial dulness, at most $4\frac{2}{3}$ inches, in both diameters. The impulse of the heart moderately strong; the apex beats about an inch below the breast. In the præcordial region, the two valvular sounds are very dry, parchment-like, especially the second; a slight souffle accompanies the first at the level of the aortic orifice. In ascending towards the arch, the souffle becomes more intense, approaching a sibilant sound; it is followed by a dry, parchment-like flapping. The same souffle extends into the spaces above and below the clavicles on the right side; it may be distinguished, though more feebly, on the left side; towards the apex, and a little below, the souffle ceases. Above, and to the inner side of the right clavicle, there are beatings perceptible to the eye, and distinct vibratory thrill. Dilatation of the right jugular; a branch goes from it to anastomose with the left, which is not dilated. The pulse is the same at both wrists, the left being, perhaps, a little the most developed; it is 64, regular, small, and vibrating. The crural arteries feel almost cartilaginous, with irregularities on their surface; their pulsations strong and resisting; on strong pressure, their sound is transformed into a very distinct souffle; under pressure more moderate, a sensation of a fillip; no vibratory thrill.

Diagnosis. — Hypertrophy of the left side of the heart, especially the ventricle, with dilatation. Valvular thickening. Dilatation of the aorta, innominata, the commencement of the right subclavian and carotid arteries, with cretaceous state of the same. General hypertrophy of the arterial system, with cartilaginous induration of the parietes; of the crurals especially.

On the evening of the 14th, the patient, who had no symptom of approaching death, complained of shivering, regained his bed, and was seized with considerable difficulty of breathing; and notwithstanding a bleeding, died at 10, P. M.

Autopsy. — The surface of the heart uncovered by the

lung was $4\frac{2}{3}$ inches transversely, and 4 inches vertically. The left ventricle, considerably hypertrophied, constituted seven-eighths of the whole organ; its cavity was dilated, and its parietes were a little more than an inch thick at the base, and 5 lines thick at the apex. The bicuspid valve was well formed, but thickened; the tricuspid, opaline, a little thicker than usual, is roughened by a few small wart-like productions. The valves of the pulmonary artery were thin, normal; the aortic valves, thickened, offering also the same wart-like products, were well formed, and sufficient. The aorta, covered by the lung in its whole extent, was considerably dilated; its parietes at least three times as thick as usual, the thickening extending into the descending aorta; on its internal face, especially towards its origin, numerous calcareous plates; besides, near the arch, several red patches and lacerations, which were also found in the innominata; this last was also dilated, but to a less degree, as well as the right subclavian and carotid. Thickening and cretaceous state of the innominata, ceasing at the origin of the subclavian and carotid. The right radial artery slightly more developed than the left; the crurals presented no cretaceous plates on their interior, but their parietes were thickened.

On comparing the lesions found at the autopsy with the details of the diagnosis, one would be tempted to suppose that the latter were written after the former were known. We shall always remember the admiration of the assistants, and we may add our own astonishment, at this apparent divination, of which long practice had not then solved the mystery; the more wonderful, that this diagnosis, so minute, so precise, and so quickly proved by the autopsy, was the result of a single examination.

We shall make but few remarks upon this case. We meet here, for the first time, the dry, parchment-like sounds; we see these sounds corresponding to a thickening of the valves. A slight souffle accompanied the first sound

towards the aortic orifice. The aortic valves were not only thickened, but roughened by small vegetatious, fibrinous rudiments deposited there, doubtless, by the coagulation of the blood, less numerous on these valves than on those in which end the "tendinous chords." But the tricuspid valve presented these vegetations. Why did it not give rise to a souffle? if not at the first time (since it was sufficient), why not, at least, at the second? Because this souffle, if it existed, must have been so light as to be masked by the flapping of the aortic and pulmonary valves; and also deeper seated, as souffle of the right heart, than that of the aortic orifice.

In proportion to the distance from this orifice, following the arch, the souffle of the first time predominated; it was produced, then, in the aorta, and not at its orifice. But why did it not exist at the second time? For the answer to this question, we refer to the preceding observation.

Finally, the pulse was vibrating, and little developed; vibrating, in consequence of hypertrophy of the left heart; little developed, in consequence of aneurysmal dilatation of the aorta.

This observation proves that an aortic souffle, at the first time, may depend on the condition of the aorta itself, rather than of its valves. The preceding one shows that souffle, at the second time, may depend on the same cause, and consequently simulate aortic insufficiency. Let us see now if this same cretaceous state of the aorta can ever produce a double souffle; this the following fact will prove.

Observation 8th. — *Double souffle from aneurysm and cretaceous state of the thoracic aorta.* We published, in the Revue Medicale (for May, 1841), a detailed account of an aneurysm of the thoracic aorta, which offered this peculiarity, — of development from before backwards, making its appearance on the back, in the form of a double tumor. The absence of all prominence, unless a very little in the

præcordial region, the increase of dulness, the obscurity of the two sounds, had at first led to the supposition, on the patient's entrance, the 20th of March, 1838, of hypertrophy, with slight thickening of the valves, without insufficiency. A slight friction sound, supposed in the pericardium, existing especially at the second time, led besides to the supposition of adhesions.

Pain was soon felt in the region of the left scapula, and the examination of this part led to the discovery of a pulsation, raising the fingers strongly, and producing under the ear a sound of a shock, accompanied by a slight souffle. The diagnosis was then completed, as follows:—aneurysmal dilatation below the arch of the aorta, with cretaceous plates in the same. The tumor increased slowly; it seemed even to be diminished at the end of the first three months. At this time, a double souffle was heard in the heart; dry, rasping, having its maximum at the first time, and towards the aortic orifice.

This remained during the whole of the long duration of this painful disease, which terminated in death, the 18th of September, 1840. We often distinguished this double souffle both at the posterior part of the trunk, and in the præcordial region itself; until, probably from the thickness of the fibrinous layers on the interior of the aneurysmal sac, it became so dull and distant, as to be heard with the greatest difficulty.

We shall not here enter into all the details of the autopsy; for which see the review above-mentioned. We shall only observe (what concerns our subject) that the aorta alone gave the reason of the double souffle, being so remarkably dilated that a mould was taken of it; and, besides, it was rough, thickened, and studded with fibro-cartilaginous plates, even almost osseous. As to the heart, (its hypertrophy apart,) it offered no valvular lesion, except a slight thickening of the bicuspid valve, and especially of the aortic valves; but

without deformation, or comparative dilatation of the corresponding orifices.

It has been seen, by the preceding facts, that certain lesions of the aorta, and especially a cretaceous state of its arch, may simulate, as to stethoscopic signs, lesions of the valves. It is well to bear in mind this cause of error, as we have seen that it is not impossible to be deceived by it. A question to which this naturally brings us, is the following: how to diagnosticate those cases in which the valvular and aortic lesions coexist? Is this diagnosis, in fact, possible? We answer, Yes: and we have already seen it in the fifth observation; but in those cases only where the two kinds of lesions present a certain degree of intensity; if not (unless there is evident predominance on the part of the aortic lesions), the odds, under a semeiological point of view, will always be in favor of the valvular affections. We shall show this in the following observation.

Observation 9th.—*Coexistence of valvular lesions, and cretaceous state of the aorta.* Jean Baptiste Leblois, printer, aged 47 years, entered the hospital, the 14th of September, 1841. Subject, for twenty years past, to rheumatic pains, usually without fever; he has had violent colds, accompanied by fever, and paroxysms of dyspnœa and palpitations, which, at first separated by long intervals, but gradually becoming more frequent, have arisen, for the last six months, on the least exercise.

Present condition.— General paleness; the face neither œdematous, nor livid; slight œdema in the lower extremities; heat of the skin, normal; pulse, 112, developed, vibrating, strong. No evident præcordial prominence; the point of the heart visibly raises the sixth intercostal space, but to the inside of the breast; the impulse is extensive, without vibratory thrill; the dulness is about three inches in both directions. On ausculting the præcordial region, three distinct phenomena may be noticed; a heavy, dull sound at the first

time, due to the shock of the apex; effacing of the valvular flappings, especially the second; and finally, souffle. As to this last, it is little marked in the regions of the left auriculo-ventricular orifice; and it is distinguished at the first time especially; while in the region of the aortic orifice, and of especially the ascending aorta, it exists at both times, most marked at the second. It is propagated, but feebly, to the carotids; these arteries present strong pulsations, which are also perceived in the abdominal aorta, and the crurals especially, giving to the ear the sensation of a very distinct fillip. No distension of the jugulars; nothing remarkable in the respiratory apparatus, except a fine subcrepitant râle, at the posterior and inferior portions of both lungs.

The next morning, M. Bouillaud, who had given the visit to our charge, verified what has been here said, without adding anything; and left us to make out the diagnosis, which was as follows: —

General and considerable hypertrophy of the heart (about 16 ounces). Thickening and induration of the left, especially the aortic, valves, without contraction of the corresponding orifice, or insufficiency of the bicuspid valve.

Why was not added, insufficiency of the aortic orifice? Because this was hardly consistent with the strong, well-developed pulse. But, as we did not attribute to this cause the souffle of the second time, we should have admitted, to explain it, the cretaceous state of the aorta. But still farther; ought we not to have admitted the aortic insufficiency also? It is, we think, proved that the cretaceous state of the aorta generally supposes a certain degree of hypertrophy in the parietes of this vessel. Would not this hypertrophy explain the qualities of the pulse, which seemed incompatible with the regurgitation of the blood into the ventricle? Certainly, if the pulse had been vibrating merely; but not, if this vibration was accompanied by a considerable development; at least, we cannot reconcile these two difficulties but by

admitting a slight aortic insufficiency. It was this development of the pulse, which led to the exclusion both of aortic contraction and bicuspid insufficiency. If the hypertrophy of the left ventricle explained the vigorous pulsations of the radials and carotids, still those of the abdominal aorta and crurals supposed a certain hypertrophy of the arterial system, which should have been mentioned.

To return to our patient. — Notwithstanding digitalis, diuretics, a blister on the præcordial region, &c., he gradually grew weaker. The infiltration progressed ; it affected the scrotum and penis, so as to render difficult the passage of the urine. The pulse remained, for the most part, vibrating ; but became smaller. We noticed, at intervals, a light vibratory thrill in the præcordial region. As to the souffle, which always completely replaced the second time, it became more circumscribed ; having its maximum always in the region of the aortic orifice ; much less distinct in that of the bicuspid ; and evidently propagated into the carotids. The first sound remained dull, indistinct, and perhaps accompanied, towards the bicuspid region, by a slight souffle.

This patient having been the object of frequent clinical studies, on the evening before his death, which took place the 17th of November, we resumed, at the visit, the diagnostic signs noticed in the later explorations, and completed the first diagnosis, as follows : —

Hypertrophy, general and considerable, of the heart (16 ounces, at least) ; affecting the left ventricle especially, whose walls must be much thickened. Moderate dilatation of the auricles and auriculo-ventricular orifices. Thickening and induration of the left valves ; the play of the bicuspid valve being a little less free than normally, without remarkable insufficiency ; more considerable deformation of the aortic valves, which close incompletely their orifice, and perhaps present some small vegetations. No considerable effusion into the pericardium ; perhaps some false membranes. Œdema of the lungs.

Let us give our reasons for this diagnosis.

Hypertrophy, &c. — Displacement of the apex; increased extent of impulse; increase of dulness — *affecting especially the left ventricle, &c.;* pulse, in general, vibrating and strong; sound of the shock of the apex heavy and dull.

Moderate dilatation of the auricles. — *Dilatation;* for 1st, in general, in every considerable hypertrophy, there is dilatation of the auricles; 2d, infiltration of the legs, penis, lungs; therefore stagnation of the blood in, and hence dilatation of, the auricles; these losing in contractility what they gain in capacity — but there may be stagnation of the blood from narrownesss of the aortic orifice, or insufficiency of the bicuspid; here, however, there were neither: hence it should be added, that it is especially the right auricle which is dilated. *Moderate dilatation;* because, in extensive dilatations, the pulse is very small; which is not the case here. And of the *auriculo-ventricular orifices*, because when the auricles are dilated, the orifices are also in proportion, for the most part.

Thickening and induration of the left valves — effacement of the two valvular flappings.

Slight obstruction to the play of the bicuspid valve — effacement of the first sound; with a slight souffle, perhaps bicuspid.

Without remarkable insufficiency — the souffle is very slight; probably even belonging to the tricuspid orifice. Besides, the pulse is developed and vibrating.

More considerable deformation of the aortic valves; the souffle is at its maximum in the aortic region, and is propagated to the carotids.

Which do not completely close their orifice; for there is souffle at the second time, from reflux of blood from the aorta into the left ventricle. There were fewer reasons than at the first diagnosis, for admitting a cretaceous state of the aorta; still, if it had been mentioned at the first examination, our opinion would now be the same.

Presenting, perhaps, some small vegetations—for, at intervals, there was a little vibratory thrill. If cretaceous plates had been admitted, this supposition would have been unnecessary.

No considerable effusion into the pericardium—the sounds were not distant from the ear; and there was no præcordial prominence.

Perhaps pericardiac false membranes—in this region, towards the base of the heart, we often heard a dry râle, whose nature and seat we were not at first able to state, supposing it might be produced in the bronchi; but its persistance, the difficulty of perceiving it on account of the sounds of the heart, and its apparent independence of the respiratory movements, ended in the supposition of friction between the two surfaces.

Finally, *œdema of the lungs*—subcrepitant râle towards the base of both lungs.

Autopsy.—The pericardium contained a small quantity of serosity. On the external surface of the heart, about the middle of the right ventricle, there were two or three prominent layers of false membrane. The heart was considerably distended by recent coagula, which filled especially the right cavities, and gave to the whole organ a globular aspect; its point rounded; well washed, it weighed, with the origin of the large vessels, 17 ounces. The hypertrophy occupied especially the left ventricle, whose walls were four-fifths of an inch thick.

The left auricle was hardly, if at all, dilated; its bicuspid orifice was 4 inches in circumference. The right auricle, on the contrary, was greatly dilated; it could have contained a moderately sized orange; its tricuspid orifice was 5 inches in circumference, instead of $4\frac{1}{2}$. The bicuspid valve was slightly thickened, but sufficient; the tricuspid had its normal thinness.

The enlarged aortic orifice presented a circumference of

$3\frac{1}{2}$ inches, instead of $2\frac{3}{4}$; its sigmoid valves very thick, fibrous, and insufficient; for water poured into the aorta penetrated immediately into the ventricle. The aortic orifice was bordered, towards the artery, even to the height of 14 lines, by cretaceous plates, prominent, and grating under the nail, by which they were removed with difficulty; representing a kind of uneven, undulating ribbon; there were a few of these plates in the descending aorta.

The pulmonary artery was healthy; the circumference of its orifice being about 3 inches; its valves were thin, and well formed. The right ventricle was a little dilated, its walls being about 3 lines thick.

The lungs presented a serous engorgement, general and well marked; a frothy serum issuing in abundance on the least pressure of the incised surfaces.

We omitted to notice the hypertrophy of the arterial system.

Notwithstanding this unfortunate omission, and others mentioned above in the diagnosis, we ask every candid observer, if there are many organs in the body, whose morbid alterations can be analyzed with such detail and precision? Still there is not perfect agreement between the last diagnosis and the autopsy. Thus, it was said, dilatation of the auricles, while the right only was dilated. The effacement of the first sound, and the light souffle heard at the first time in the left auriculo-ventricular region, were explained by slight obstruction in the play of the bicuspid valve; but the autopsy has shown that its play was free, but the valve a little thickened; this light souffle, perhaps, was produced by the slightly insufficient tricuspid orifice, or, more probably, by the orifice of the aorta, in the region of which this souffle at the first time was so distinct.

The cretaceous state of the aorta, which has been the subject of the last four observations, has led to a digression, which we are far from thinking useless; but which we can-

not pursue farther, without losing sight of the strict method which we wish to follow as much as possible in these clinical researches. To return, then, to the lesions of the heart, properly speaking. We have passed in review the alterations of the two principal orifices, separately ; let us now examine those cases in which the two orifices are simultaneously affected. In this study, some clinical point will offer itself, perhaps, which may lead to digressions ; but we shall abstain from them, unless justified by the importance of the subject.

Observation 10th. — *Double contraction, without aortic insufficiency.* Sophie Roulleau, seamstress, aged 17, was admitted to the hospital, the 25th of March, 1841, having been sick, according to her statement, 10 months. At that time, she was attacked by a general acute, articular rheumatism, which confined her to her bed for about 2 months ; since which time, she has been subject to palpitations, which commenced during her rheumatism. In the month of February last, she was seized with pain and swelling of the abdomen, with slight diarrhœa, and cough ; these latter symptoms brought her to the hospital.

Present state. — Paleness, anemia, and general emaciation ; considerable ascites ; skin hotter than usual ; pulse at 124, very small, and easily effaced by pressure ; palpitations even in a state of rest. Slight præcordial prominence, being, by the cyrtometer, about 3 degrees more than normally ; beatings of the heart strong, visible ; extending, as well as the dulness, from the 5th intercostal space (almost immediately below the breast) to the second intercostal space above : the hand here perceiving a kind of rude shock, due to the sudden passage of the blood, but without vibratory thrill properly speaking. Below the breast is only heard a double souffle, rough and rasping, without valvular flapping ; above the breast, and especially towards the left clavicle, a souffle, at the first time only, is heard, the second sound being a hard, sudden, and parchment-like flapping. The souffle at the first

time is prolonged into the carotids, without " bruit de diable," at present. The left subclavian artery beats in a visible manner ; the jugulars are sensibly developed. The respiration is rapid, difficult, without other morbid sound, than a slight sub-crepitant râle at the base of the left lung. The feet are œdematous.

On the 26th, M. Bouillaud dictated the following diagnosis : general hypertrophy of the heart (12 to 14 ounces). Thickening and probably vegetatious, with deformation of the left valves.

Let us see if our former observations do not justify us in adding to this diagnosis. The hypertrophy of the heart, and its increased weight were too evident, to repeat the reasons of this opinion.

Thickening, and probably vegetations of the left valves — this duplicity of lesion is evident. For we have, in the aortic region, a rough souffle at the first time, which is propagated to the carotids ; therefore the aortic orifice is diseased ; in the præcordial region, we have two souffles ; whence comes the second ? Is it from this same aortic orifice, imperfectly closed, insufficient, and consequently not in a condition to produce a valvular flapping ? No ; for in ascending towards the clavicle, a moment arrives when we hear a second valvular flapping, hard, rough, and parchment-like, evidently produced by the thickened, but sufficient, aortic valves. The bicuspid orifice is, then, the seat of this second souffle.

There was perceptible to the hand a rude shock, or quivering, which seemed to be owing to the sudden passage of the blood. What does this shock indicate ? A considerable obstacle to the escape of the blood by the orifice of the aorta. What is this obstacle ? Is it a simple contraction ? Were this the case, we should have, at the first time, a peculiar, sharp souffle ; but it is rough and rasping. Is it a cretaceous state of the sigmoid valves ? Possibly — but this is generally complicated with a cretaceous condition of the aorta ; and

here there is not this condition of the aorta, since, at this region, there is no souffle at the second time, as most commonly happens. It is most probable, then, that there are vegetations around this orifice, and perhaps (but this is a mere gratuitous supposition) also of the bicuspid orifice. From this analysis, we may add a new element to the diagnosis, viz. the sufficiency of the aortic valves.

What shall we say of the other orifice? Nothing positive; although it is not probable that it is considerably insufficient. For, how then should we have, after the escape of the blood by the aortic orifice, this rude shock, which indicates that the left ventricle is the essential seat of the hypertrophy? But it is said, the pulse is very small — in an anæmic young person, this is of trifling importance; still it might be a reason for supposing a slight contraction of the bicuspid orifice, or even the aortic.

But should the right side of the heart be left unnoticed? With so considerable a hypertrophy, with so many signs of evident obstruction to the venous circulation, the ascites, the distension of the jugulars, and the serous congestion of the lungs, it is very probable that the right auricle is distended (if only passively); and that there is also dilatation both of the auricle and its corresponding orifice.

Our diagnosis was soon to be verified. The infiltration progressed, the abdomen was enormously distended; the heart was so pushed up by this, that it could be seen beating in the first intercostal space; and notwithstanding two paracenteses, followed by a momentary relief, the patient died on the 18th of May.

Autopsy. — To pass immediately to the heart. Freed from coagula, this organ weighed about 15 ounces. The hypertrophy affected both the right and left cavities — the right ventricle was a third larger than usual; the thickness of its walls about two-fifths of an inch, at its middle portion.

The tricuspid orifice was large in proportion to the ven-

tricular cavity; the folds of its valve were thickened, and perhaps a little too short to close the dilated orifice; a few small vegetations on the free edge of the valve. The auricle was proportionably dilated; its columnæ quite strong. Nothing remarkable in the pulmonary artery.

Water poured into the aorta did not penetrate into the ventricle; indeed, the three valves were well-formed, of three times their normal thickness; but upon their free edge, and towards the ventricle, there was a series of cauliflower excrescences. The aortic orifice was small, absolutely, and relatively to the size of the ventricle.

The ventricle was large enough to contain a common-sized egg; its walls were 14 lines thick, towards the base; the two columnæ of the bicuspid valve were enormous; one of them had the volume of the ring-finger. This valve was very thick, and hypertrophied; its orifice well-formed; still the angles of the valve were united by adhesions. The whole free edge of the valve was studded with close, granulated vegetations, resembling a cauliflower. The cavity of the left auricle was dilated in proportion to the ventricle, and its walls were also thickened. The mitral and aortic orifices were both diminished relatively to the increased capacity of the auricle and ventricle.

It is unnecessary to make farther comment on this autopsy; it is to be regretted that the dilatations were not numerically indicated. This autopsy, as above indicated, was dictated at the amphitheatre by M. Bouillaud himself.

Observation 11th. — *Deformation of the valves, without contraction.* Joseph Doumerc, aged 48, shoemaker, entered the hospital the 28th of October, 1841. This patient, who had been in the hospital before, stated that, formerly always enjoying good health, he was attacked, nine years ago, with an articular rheumatism, accompanied by fever, which affected all the principal articulations, and of which he was only cured at the end of three months.

About twenty months ago, he began to experience palpitations, which went on gradually increasing, and forced him, nine months ago, to renounce his occupation. Since the same time, he had been unable to sleep in a horizontal position, passing frequently whole days in his chair; for a few months past, an evident infiltration of the lower extremities and abdomen. He has had, since four or five months, symptoms of sero-sanguineous congestion of the lungs, as pain in the side, very rusty expectoration, which were combatted by two bleedings, two applications of leeches, and numerous blisters.

Present condition. — Almost upright in bed, he is affected with great dyspnœa, the respiration sensibly accelerated, and his answers brief. His face is pale, slightly swelled; the lips a little violet; the abdomen is remarkable for its volume, and is somewhat sensitive from the distension; the least shock determines a most evident fluctuation; and it is only at about a hand's breadth above the umbilicus, that it ceases to be felt, and percussion ceases to produce a dull sound. The semi-circumference of the abdomen, at the umbilicus, is 22 inches. The urine is passed with extreme difficulty, the penis being infiltrated in its whole length, and twisted upon itself; the scrotum is also greatly infiltrated. The extremities, even the upper, participated in this condition; the thighs and legs are considerably increased in volume.

The pulse, difficult to perceive, from the œdema of the wrists and its smallness, is evidently not in proportion to the patient's strength; equal, intermittent, at 116 to 120. Præcordial prominence of 6 degrees by the cyrtometer. The point of the heart beats in the fifth intercostal space, but a little to the outside of the breast; from this point the beatings extend to 2 inches above the breast; the heart being also pushed up by the abdominal effusion; they are visible, but moderately strong. The dulness corresponding to the heart is 3 inches vertically, and nearly 4 transversely; no vibra-

tory thrill. The sounds of the heart, somewhat masked by the interposition of a part of the lung, are indistinct, without sensible flapping, and without souffle at the present time; still, in ascending along the aorta, there is distinguishable, at the first time, a kind of distant cry, very short, which may be followed in the præcordial region even to the aortic orifice, but not propagated to the carotids. These last beat quite feebly; the jugulars are evidently distended. The respiratory apparatus presents nothing remarkable but a slight diminution of resonance towards the base of both lungs, and fine subcrepitant râle, especially to the left.

M. Bouillaud being absent, we dictated the following diagnosis: — *Considerable hypertrophy of the heart* (about 16 ounces). *Absolute and relative dilatation of the auricles. Thickening, deformation, and perhaps adherences of the left valves in particular, without great absolute contractions or vegetations. Perhaps contraction of the pulmonary orifice, in particular. Slight effusion into the pericardium. Œdema of both lungs. Ascites and anasarca.*

Twelve days after, this was submitted to the test of the autopsy, paracentesis, giving issue to a great quantity of liquid, having afforded but a momentary relief. The sounds of the heart remained the same; except the slight, crying sound of the first time, which appeared only at intervals, and finally ceased.

Autopsy, the 4th of November. *Thoracic cavity.* — Œdema of both lungs, behind and at the base. The pericardium was uncovered in an extent of $5\frac{1}{2}$ inches transversely, and $3\frac{1}{2}$ vertically; it contained about a tumbler-full of a limpid serosity.

The heart was enormously and generally hypertrophied; opened and washed, it weighed 23 ounces.

Right side. — The auricle presented a vermilion color, and strong columnæ, and would have contained a small orange. The circumference of the tricuspid orifice was $4\frac{2}{3}$

inches; the valve was thickened, but well-formed, although slightly adherent to the ventricle, towards its middle portion. The ventricle was proportionably dilated; with strong columnæ; its walls, towards the base, being 5 lines thick. The orifice of the pulmonary artery was $3\frac{2}{5}$ inches in circumference; its valves proportionably increased, but sufficiently thin, and well-formed. The interventricular septum was four-fifths of an inch thick.

Left side.—This auricle was a little larger than the right; its orifice being five inches in circumference. Its valve was thick, almost fibro-cartilaginous; its folds resembling a ribbon, not adhering to the ventricle, but confined by short tendons, which must have restrained its free play.

The ventricle, the essential seat of the hypertrophy, was remarkable for the strength of its columnæ, which were short and thick; from the base of one of them arose a small tendinous filament, very thin, which was inserted on the corresponding side of the ventricle, about an inch below the aortic orifice; at the point of this insertion, the endocardium (here opaline) presented a small plate, slightly projecting, about 3 lines in extent, and a line thick, of a fibrous appearance. The wall of the ventricle was firm, and four-fifths of an inch thick; this did not decrease till in the neighborhood of the apex, which was rounded.

Water poured into the aorta did not penetrate to the ventricle; the valves were, then, *sufficient;* but thickened, increased in size, their depth being about 9 lines, instead of 5; the circumference of the orifice was about 3 inches. As the right side, the left side of the heart contained only some blackish, soft, unorganized concretions.

Let us compare the cadaveric lesions with the principal points of the diagnosis. It was said: *considerable hypertrophy* of the heart (about 16 ounces); and we have found 23. We will not repeat the general reason of this error; the principal reason of this small estimate was the situation of

the apex, placed, from the abdominal effusion, in the fifth intercostal space, and only slightly to the outside of the breast.

Relative and absolute dilatation of the auricles. We reasoned thus: the auricles are dilated, not only relatively to their usual capacity, and that of the ventricles, but also absolutely, *i. e.*, without reference to this relation; for the hypertrophy is general; there has been, for a long time, stagnation of the blood; but, as there is no sign of mitral or tricuspid insufficiency, if the blood remains in the auricles, it is because, being dilated, they have lost their contractility. The autopsy has confirmed this, by showing, it is true, a dilatation not less pronounced of the ventricles than the auricles themselves; the former being thinned in the thickness of their walls, and consequently less strong in their contractions. For what is four-fifths of an inch of thickness, towards the base of the left ventricle, in a heart weighing 23, instead of 9 ounces, when the average thickness of this ventricle is three-fifths of an inch? From this circumstance, doubtless, resulted the moderate impulse of the heart, the smallness of the radial pulse, the indistinct sounds; and from the stagnation of the blood, the serous infiltrations, the distended jugulars, the dyspnœa, &c.

Thickening, deformation, and perhaps adherences of the left valves in particular. Why? Because the two sounds were indistinct; because there was no where valvular flapping; we should, consequently, suppose the play of the valves obstructed; and, as the absence of souffle and vibratory thrill exclude the idea of calcareous plates and vegetations, it is probable that the valves are adherent, either among themselves, or to the ventricle.

What did we find? A tricuspid valve thickened, enlarged in proportion to its orifice, but adherent towards its middle part; a mitral valve also thickened, but confined by tendons too short; evidently insufficient for so large an orifice (5 inches, instead of 4), allowing, consequently, a portion of

the blood to retrograde at the first time, as the considerable dilatation of the left auricle proves. If it be asked why this bicuspid insufficiency did not give rise to a souffle at the first time, the reason is, doubtless, in the little force with which the column of blood was expelled from the dilated left ventricle.

How were found the arterial orifices? The aortic, and particularly the pulmonary, valves were enlarged, and therefore less likely, than in the normal state, to produce a flapping.

Without absolute contraction, or vegetations; we might have added, and *without cretaceous plates.* The absence of souffle and vibratory thrill put this beyond doubt; this the autopsy confirmed.

Perhaps narrowness of the pulmonary orifice. This was a mere supposition, based upon the slight cry, distant from the ear, not propagated into the carotids, and heard in two or three places between the breast and sternum; this was not verified by the autopsy. Still we are by no means sure that the pulmonary orifice was not the point of departure of this feeble and distant sound; but, be it understood, not from a fixed lesion, but simply some temporary and movable obstacle, as a small fibrinous concretion, which the stream of blood might have afterwards removed.

Slight effusion into the pericardium. The tumbler-full of serosity will not be objected to; for what is this quantity compared to the capacity of the enlarged pericardium? The apex, which was felt beating in the fifth intercostal space, did not permit us to allow a considerable effusion, which would have been incompatible with such nearness of the organ.

We shall say nothing of the pulmonary œdema; and shall terminate this analysis, as the preceding, by asking if the agreement between the diagnosis and the autopsy is not complete enough to prove the value of the means of obser-

vation, by the assistance of which such a practical result can be obtained.

Observation 12th. — *Thickening and deformation of the left valves. Moderate contraction of the aortic orifice.* Joseph Voisin, aged 53, porter, entered the hospital, the 20th of August, 1841. Of strong constitution, formerly a soldier for 25 years, he has been generally in good health; he has had, however, two attacks of intermittent fever, one in 1808, the other in 1815, each of which lasted a month. In 1818, he appears to have had an inflammation of the left side of the chest, which lasted three months; and finally, in 1826, he was affected with rheumatic pains, in the arms and legs especially, with fever and copious sweats. Treated then at Val-de-Grâce, by cupping and a bath, he pretends to have left the hospital in a week. Since then in good health, he remarked a year ago that his respiration became shorter, and that his heart palpitated after ascending a height. These symptoms have increased within the last month; to which has been added a slight swelling of the inferior extremities, partly disappearing in a horizontal position. He has kept his bed for three weeks, though not continually.

Present state. — No puffy swelling of the face; marked œdema of the feet, legs, and left wrist; no positive signs of ascites. The pulse 76, vibrating; especially the right, which is more developed than the left, doubtless on account of the œdema mentioned; the pulsations of the right radial are felt over an extensive surface. Between the left breast and the sternum, there is a prominence of about six degrees. The beatings of the heart extensive; although the apex, difficult to feel at first, beats in the fifth intercostal space only, and rather to the inside than the outside of the breast. The hand, firmly applied to the præcordial region, perceives a vibratory thrill, very distinct, but deep-seated; the dulness seems to be only $2\frac{1}{2}$ inches in each direction; but the presence of the lung does not allow this to be exactly determined.

In the præcordial region, particularly towards the apex of the heart, is heard a souffle at the first time, which occasionally resembles a "whistling cry;"[1] the second sound is completely silent; in its place is heard, with difficulty, a very short souffle. Towards the base of the organ, and on approaching the aortic orifice, the first souffle persists; but the second, at the same time becoming more distinct, is accompanied by a clear flapping; in the direction of a line drawn from this point to the right clavicle, the double souffle becomes still more distinct, its maximum intensity seeming to be about the middle of this line; no tumor, however, nor vibratory thrill, here exists under the hand. The souffle is propagated to the carotids, which beat forcibly and visibly,—also to the subclavians; in the right subclavian, there may even be perceived a vibratory thrill. No considerable distension of the jugulars; forcible beatings in the cœliac trunk, the abdominal aorta, and crurals; but no souffle. Nothing remarkable in the respiratory apparatus.

If the analysis of the preceding observations has been read with care, the diagnosis of this case will be seen at once in the simple statement of the symptoms, as it were through a transparent veil. Let us, however, distinguish its principal features, and see if the present diagnosis is in relation to that given at the bed-side, and especially to the autopsy.

We noticed, at first, *slight and partial œdema;* hence there is a certain obstruction to the venous circulation; but there is not, as in the preceding case, *general anasarca, or ascites;* hence we shall not find such evident marks of stagnation of the blood. Besides, these cannot be exactly determined but at the end of our examination.

There is here, doubtless, *general and considerable hypertrophy;* it may be asserted that the heart has double its normal weight (16 to 18 ounces). But what kind of hyper-

[1] Piaulement.

trophy? Is it, as in the preceding case, a hypertrophy, in a manner, *passive*, with dilatation, and thinning of the walls? No; for the vibrating pulse indicates, on the contrary, an *active* hypertrophy, affecting, probably, the left ventricle in particular. As to the orifices, the vibration and development of the pulse at first exclude all idea either of considerable contraction of the aortic orifice, or of marked insufficiency of the mitral valve; still, on applying the hand over the præcordial region, a thrill was perceived; the *orifices are, then, considerably affected.*

What does auscultation afford? Towards the apex (that is, in a manner between the bicuspid and aortic orifices) there is a sharp souffle at the first time, and a much shorter one at the second time; no flapping sound. To what orifice do these souffles belong? Do they proceed from the aortic orifice, insufficiently opened, and insufficiently closed? To find out this, apply the ear to this orifice; the first souffle persists, and the second becomes more distinct; but, strange to say, the latter is accompanied by a clear flapping sound. How can this be explained? Just now, when the souffle was short, there was no flapping; now, when it is more distinct, there is valvular flapping.

The answer is easy; it is that these two souffles of the second time are, doubtless, of different origin. The first was produced at the bicuspid orifice, and, short as it was, it sufficed, from its nearness, to mask the flapping of the aortic valves. On approaching this orifice, its flapping becomes distinguishable; if it be mingled with souffle, and a souffle stronger than the first mentioned, the cause is, probably, in a peculiar condition of the internal surface of the aorta. On pursuing the examination, this hypothesis will become a certainty, when, by following the course of the ascending aorta, it will be seen that in this region the double souffle presents its maximum intensity.

To resume the diagnosis, — we say: *deformation of the*

two left orifices, the bicuspid valve being perhaps insufficient [no flapping at the first time] ; *but to a feeble degree* [development of the pulse] ; *the sigmoid valves not being insufficient* [flapping at the second time] ; *but the orifice which they close being contracted* [shrill, whistling cry (piaulement) at the first time, towards the aortic orifice]. It may be added, *cretaceous plates in the aorta ;* and, finally, to explain thus the beatings of the arterial system, *hypertrophy of the principal arteries.*

Our first diagnosis was not so complete. M. Bouillaud being absent, the following was the diagnosis at first: *General and considerable hypertrophy of the heart. Thickening and deformation of the left valves. Hypertrophy of the principal arteries.*

Later, from the persistence of the whistling cry, we added: the principal lesion is at the *orifice of the aorta,* and consists in a *contraction.*

Let us pass to the *autopsy*, which took place the 24th of September, the patient having expired the evening before, very suddenly.

Autopsy. — No serosity in the pericardium. The heart, almost globular, rounded at its apex, weighed, with the origin of the large vessels, 19 ounces ; this hypertrophy affected particularly the left ventricle. The four cavities did not contain any considerable concretions.

Right side. — The auricle was sensibly dilated ; it would have contained a large egg ; it was firm, fleshy, vermilion-red internally. The tricuspid valve was a little thicker than normally, but without deformation ; the circumference of its orifice was about $4\frac{3}{5}$ inches. The ventricle was moderately small and narrow, in comparison with the auricle ; nothing remarkable in its walls, which, even towards the base, were only five lines thick. The valves of the pulmonary artery were well-formed ; the orifice was about three inches in circumference.

Left side.—The auricle was dilated so as to have contained a small orange. The bicuspid orifice, which partook of this dilatation, was about $4\frac{3}{5}$ inches in circumference (instead of 4); its valve was considerably thickened, almost cartilaginous; roughened at its free edge by small, fleshy vegetations, without cretaceous matter; there were vegetations even upon its chordæ tendineæ; the columnæ carneæ were remarkable for their size and strength. The ventricle was less remarkable for its dilatation than the thickness of its walls; these were about 15 lines thick towards the base; a very little less at the apex. Its tissue was firm, vermilion-red, and resembled a vigorous muscle. The endocardium presented a slightly opaline appearance. The aortic orifice was manifestly contracted, both relatively and absolutely; its circumference about $2\frac{3}{4}$ inches (3 lines less than the pulmonary orifice, while normally they are about equal). Its valves were very distinctly thickened, especially towards their free edge, which was rough, irregular, presenting small vegetations, as it were *atheromatous* (and many of them even *osseous, or stony*), small, more perceptible to the touch than the sight. The origin of the aorta also presented concretions, with slightly projecting plates, of this same matter, quite rough to the finger; these were found even in the middle of the descending aorta. The aorta was also remarkably thick; and all the large arteries participated in this hypertrophy; one of the crurals, opened and compared with the normal size, presented a capacity almost double.

Was not the history of this autopsy almost completely written in advance, in the analysis of the symptoms? We have seen in addition, however, the *dilatation of the auricles*, particularly the *left*, which is another reason for admitting the *insufficiency of the bicuspid valve*, the corresponding orifice being sensibly dilated ($4\frac{3}{5}$ inches instead of 4). This dilatation of the auricles, a cause exceedingly probable, though secondary, of the stagnation of the blood, explains

the evident, but little extensive, infiltrations noticed. Another defect in our analysis is the existence of the *small vegetations*, which the *vibratory thrill* might have led us to suspect; a thrill, caused wholly by these vegetations, unless the cretaceous plates, or the aortic contraction, might have contributed feebly. It should be remarked, as regards these small fibrinous concretions, veritable rudiments of calcareous and other concretions, that their disposition, on the free edge of the bicuspid valve, and along the tendinous chords of this valve, seems to give the key to the mechanism of their formation. *What more analagous to the rods, on the branches of which the fibrin of the blood is deposed in our laboratories, than these delicate chords, continually agitated in the midst of the blood, itself violently agitated by the energetic contractions of a hypertrophied ventricle?*

Observation 13th. — *Double contraction, with bicuspid, and perhaps aortic insufficiency. Adhesions in the pericardium.* Lucien Baude, aged 27, tailor, entered the wards the 2d of September, 1841; of moderately good constitution, a little delicate, and of lymphatic temperament, he was attacked, at about 9 or 10 years of age, with an acute general articular rheumatism, which has reappeared almost every year since, except within five years. At an epoch, which he does not exactly remember (but at least six years ago), he began to experience palpitations, and difficulty of breathing, which have continued ever since, but which did not occasion much inconvenience till within about 8 months. Since then, also, he has had a frequent cough; and lately, œdematous swelling of the lower extremities, then of the scrotum, and finally of the abdomen. He has kept his bed since three months.

Present condition. — The patient is seated on his bed; his face pale and swelled; considerable œdema of the feet, legs, thighs, scrotum, and penis; tumefaction of the abdomen, with slight dulness in the depending parts; the extremities cold.

The pulse 88, little developed, and somewhat unequal; præcordial prominence of 3 or 4 degrees; the beatings are profound, but extensive, and accompanied at intervals by a slight vibratory thrill below the breast. The apex beats in the fifth intercostal space, or between this and the sixth; and its beatings extend from this point to considerably above the breast, and even into the neighborhood of the sternum; the præcordial dulness is $2\frac{3}{4}$ inches in each diameter. As to the sounds, instead of flapping, there is nothing but a double souffle, rough and rasping, much more distinct at the first time than at the second, the sound of the former being almost entirely effaced; the maximum of the souffle extending to the neighborhood of the inferior hollow of the sternum. In the other points is distinguishable a *dull and heavy sound of a shock*, which is mingled with the souffle of the first time; no appreciable souffle in the carotids. These, as well as the subclavian arteries, present pulsations of great force; the jugulars are slightly distended. A subcrepitant râle is heard behind, at the base of both sides.

From these signs, what valvular lesions shall we diagnosticate? At first, this case seems more difficult to analyze completely, than the preceding; still, if it be considered that there is *absence of valvular flapping*, and more complete at the *first* time than the *second*, we shall be led to admit a *double valvular lesion*, affecting especially the *bicuspid* valve; from this complete absence of bicuspid flapping, we shall conclude also the *insufficiency* of this valve. As to the *aortic orifice*, we shall hesitate perhaps with regard to its *insufficiency;* but the almost entire, if not total, effacement of its flapping sound will not permit us to deny a certain *alteration* of this valve. The *vibratory thrill* would indicate, of itself, a decided alteration of an *orifice;* but of which? In considering the *situation* of this thrill, below rather than above the breast, there is some reason for attributing it to the *bicuspid orifice.*

Besides, such a detailed analysis is not always possible at the bedside, and from a single examination. Such was not the diagnosis of M. Bouillaud, who verified what we noticed the evening before, and dictated as follows: — *Hypertrophy of the heart and principal arteries. Induration and thickening of the left valves, with contraction of the orifices. Suspicion of adherences in the pericardium.*

Why *contraction* of the orifices? Because either this cause, or a well marked *insufficiency*, is necessary to explain the coincidence of such a slightly developed, unequal pulse, with beatings in appearance so extensive; because, doubtless, the contraction appeared to M. Bouillaud more probable than insufficiency, considering the character of the souffle, whose peculiar shade could only be perceived by a practised ear; because, finally, the vibratory thrill indicated, of itself, this lesion, sufficiently well.

Why, finally, the suspicion of *adhesions of the pericardium?* Because, as M. Bouillaud showed, the beatings were extensive, but profound, and as if confined and obstructed; because under the hand and ear, that clearly increased play and freedom of impulse of a heart simply hypertrophied, were not found. But these shades of sound were very difficult to appreciate; and M. Bouillaud himself could only state his suspicion of this lesion.

This diagnosis was soon submitted to the test of the autopsy, the patient having expired on the evening of the 9th, in a state of orthopnœa, and general weakness.

Autopsy. — The pericardium contained 5 or 6 spoonsful of a reddish, bloody liquid; its cavity was opened with difficulty (on its anterior surface), on account of intimate adhesions, and short filaments, which united the pericardium to the heart, particularly on its anterior surface and left side; it was necessary to dissect these adhesions to expose the heart. In the rest of its surface, and especially upon the right ventricle, the heart presented several whitish, thick

plates, which were detached with difficulty. The heart was considerably and generally hypertrophied; this hypertrophy affecting particularly the left ventricle and the two auricles. It contained only soft and blackish concretions; washed, it weighed, after being slightly dried, nearly 16 ounces.

Right side. — The auricle, enormously dilated, would have contained a large orange; it was firm, fleshy, vermilion-red. The circumference of the tricuspid orifice was normal, $4\frac{1}{2}$ inches; its valve, much thickened, fibro-cartilaginous, especially at its free edge, adhered to the ventricle by its extremity the nearest to the pulmonary artery. Its tendinous chords were short, firm, and ending in strong, thick columnæ. Still the right ventricle was a little dilated in proportion, and its maximum thickness (which was at its base) was only two-fifths of an inch. The valves of the pulmonary artery were well formed — the orifice 3 inches in circumference.

Left side. — Nothing remarkable in the calibre of the aorta; nor on its internal surface. The valves, sensibly thickened, were still somewhat transparent towards their middle part: but the free edge was transformed into a cartilaginous ring, grating under the scalpel, and very hard to the touch; but without ossification, or great deformation, except that the valves adhered to each other by their edges, so as to diminish the orifice, which was $2\frac{1}{2}$ inches in circumference.

The left ventricle was dilated, and would have contained a large egg; its walls were thickened, firm, vermilion-red, three-fourths of an inch thick almost to the apex, which was blunt and rounded; the columnæ carneæ were mostly strong, and particularly the two whose tendons end in the bicuspid valve. This valve, not having been incised, presented at its centre an oval opening of about three-fifths of an inch, which allowed the light to penetrate to the lowest part of the ventricle; this opening was besides entirely surrounded by a mass of cretaceous matter, forming a circular series of concretions,

or nuclei, many of which had the volume of a large pea, unequal, very hard, rough, and replacing almost entirely the valve, which was undistinguishable ; some of them were even prolonged, like stalactites, in the thickness of the tendinous chords. The circumference of the auricular-ventricular orifice, measured without opening it, was $3\frac{1}{2}$, instead of 4 inches. The corresponding auricle was large, but less than the right — it was, however, firm, fleshy, and bright red.

The lungs, especially the left, were engorged on their posterior parts.

This autopsy has little need of comment; except the hypertrophy of the arteries, which we did not note, because perhaps we did not examine for it, it completely confirms the diagnosis of M. Bouillaud : *adherences in the pericardium, and contraction of the left orifices.* It should be remarked that the bicuspid insufficiency, and the predominance of the lesion of this valve, were verified ; the symptoms, then, which called our attention more especially to these two circumstances, did not deceive us.

We no longer doubt that the adherences of the aortic valves among themselves, whence resulted in a measure the " puckering " and the contraction of the corresponding orifice, had also for result a certain insufficiency of these valves ; and that the feeble flapping of the second sound was produced much less by these valves, than by those of the pulmonary artery, more distant, but normal.

But is there nothing to be said of the tricuspid orifice ? Was not its circumference (which, in presenting the amount of a normal heart, was for that reason relatively contracted ; diminished, also, by the adherence of a part of its valve to the ventricle) in the conditions, (from this double fact,) of morbid narrowness, of imperfect closure, and of insufficiency, which should be taken into the account in explaining both the dilatation of the right auricle, and the obstruction of the venous circulation, the cause of the serous infiltrations

noticed? We are strongly inclined to this opinion. It may even be questioned, if this tricuspid lesion was not the cause of the souffle heard near the inferior hollow of the sternum, which region has been indicated in fact, and by Laennec the first, as the seat of the morbid sounds of the right side of the heart; but this question only in passing.

Thus, to return to the principal morbid phenomena; *vibratory thrill*, from cretaceous state of the bicuspid orifice.

Souffle at the first time — from aortic narrowness and bicuspid insufficiency; and perhaps also tricuspid insufficiency; these two last orifices not being able to furnish a flapping sound.

Souffle at the second time — from bicuspid and tricuspid narrowness, and slight aortic insufficiency.

Slight flapping at the second time — from imperfect play of the aortic valves, the flapping of the pulmonary being masked by the souffle.

It now remains to anticipate an objection. If the aortic orifice had any share in the production of the first souffle, why was not this souffle prolonged into the carotids? Because, doubtless, the column of blood, divided in the left ventricle between the bicuspid orifice remaining open, and the orifice of the aorta, did not strike in sufficient quantity against the latter for the souffle, which was the result of this friction, to be propagated as far as the carotids; this is proved by the feebleness of the pulse. If the strength of the pulsations in the carotids and subclavians be objected to this explanation, it may be answered that this strength is not always in proportion to the volume of the column of blood in the vessels, as is proved by the pulsations of the cœliac trunk, and the carotids themselves, often presented in chlorosis, and which have sometimes been mistaken for aneurysmal pulsations; and by those also noticed in many cases of troubled innervation, and in the cholera itself.[1]

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[1] See the Memoire of MM. Serres and Nonat on the cholera.

Observation 14th. — *Contraction and insufficiency of the bicuspid valve; thickening of the valves of the aorta. Tricuspid insufficiency. Adherences in the pericardium.* Joseph Viard, 22 years of age, varnisher, entered the hospital the 4th of October, 1840.

In good health till 18 years of age, this young man, of a lymphatic temperament, had, at that time, an acute general articular rheumatism, for which he was treated here, and which lasted 3 months. During this disease, palpitations manifested themselves, with acute pain in the præcordial region; he says he recollects, that in ausculting him was heard a souffle. These last accidents kept him a month longer in the hospital, and were treated by cupping and opiated cataplasms; finally he went out cured, no longer experiencing palpitations or difficulty of breathing. Two years after, he had a new attack of rheumatism with still stronger palpitations; at this time, it was only after 6 months that the patient could quit the hospital; and even then, he remained subject to palpitations, which, for eight months have hindered him from pursuing his occupation, and to which was added, 8 days ago, infiltration of the lower extremities, genital organs, and abdomen.

Present condition. — The patient is seated in his bed; his feet, hanging out, are infiltrated, especially their lower third, as also the scrotum and the penis. The abdomen, distended by a considerable effusion, gives a sound completely dull, as high as three-fourths of an inch above the umbilicus. The face is sensibly swelled, but pale and anæmic; the lips slightly violet; the extremities cold.

The pulse is 96, small, but regular. No præcordial prominence, no vibratory thrill; but the impulse is strong and extensive. The apex beats in the 6th intercostal space, a little to the outside of the breast; the dulness is about 3 inches vertically, and $3\frac{1}{2}$ transversely. In the whole præcordial region is heard, but especially in the region of the left cavi-

ties, a double souffle, rough, rasping, replacing the valvular sounds, and prolonged, especially at the second time; and accompanied by a mingled *auriculo-metallic tinkling*[1] and heavy dull sound, the double result of the shock of the heart against the walls of the chest; the souffle is not distinctly propagated into the carotids. There is also a subcrepitant

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[1] This must not be confounded with the *metallic tinkling of pneumo-hydro-thorax*, which is dependent on the respiratory movements; though the names are similar, the two sounds are completely different. Laennec mentions "a light metallic clicking, heard especially in nervous palpitations, when the heart, beating strongly and quickly, without impulse really great, strikes against the thoracic parietes." It is always produced during ventricular contraction, and does not hinder the other sounds from being heard; to which it seems superadded. Its intensity is variable; sometimes consisting merely in a clearer sound of contraction; at others, a slightly silvery resonance; at others still, a distinct metallic tinkling. It is well imitated by applying the palm of the hand over one ear, and giving slight quick taps on the back of the hand, with the finger of the other; from this resemblance, M. Filhos has given it the name of auriculo-metallic. According to M. Bouillaud, it is caused by the percussion of the heart against the walls of the chest, which, though producing no distinct sound in the normal state, may, under the influence of very violent beatings, or in cases of ossification of the heart and pericardium, produce a very distinct and peculiar tinkling. Hope explains it by the shock of the heart against the lower edge of the 5th rib, when this projects internally, as in emaciated individuals; what confirms this opinion is, that it can be made to cease at pleasure, by pressure on the intercostal space, so as to bring it, in the interior of the chest, into the same plane as the rib; upon this, the heart glides without sound. Laennec thought it caused, when "a large heart found itself confined in the anterior mediastinum, and there were bubbles of air in the pericardium." Piorry, and others, think it comes from the agitation of liquids, mingled with gas, contained in the stomach, from the strong impulse of the heart. It is not of much importance as a symptom; and its pathological signification is not as yet determined with precision. See Part 2d, where this subject is further considered.—*S. K.*

râle, very evident in the posterior part of both lungs, especially the right.

The next day, M. Bouillaud added, that in approaching the *right subclavian* region, the *second* sound became disengaged, being there heard very distinctly, and offering a slightly parchment-like tone. This is an important addition, as it enables us to diagnosticate this affection in a manner probably complete and precise. We have here a double souffle; is there, on this account alone, a double lesion? Probably not; or if it be double, it probably, at least, predominates in one orifice. What is this orifice? On the one hand, we have not a distinct souffle in the carotids; on the other, at a distance from the heart, there is a time when we hear the flapping of the second time, modified only in its tone. It is then, the bicuspid orifice which is the special seat of the lesion, its valve being probably insufficient, and its diameter contracted; the aortic valves being thickened, but sufficient. From the results of our former observations, we may even add, that the extent of the serous infiltrations leads us to admit also a dilatation of the right auricle, (without the left being involved,) with dilatation, and perhaps insufficiency of the tricuspid orifice.

M. Bouillaud indicated, the first day: *General hypertrophy of the heart, with thickening and deformation of the left valves.* Some days after, he added: "the rasping sound, which masks the flapping of the valves, is very rough, confined, as it were, in the region of the left cavities, where is distinguished a shock rather than sounds; but towards the lower part of the sternum, the rasping, double souffle becomes more pronounced and diffused; it seems as if the heart was confined and obstructed in the pericardium."

The patient died on the 21st of November; the autopsy was dictated by M. Bouillaud, as follows:—

Autopsy. — The parietal pericardium adhered, in its whole extent, to the cardiac pericardium; thus explaining the ob-

structed movements of the heart. This adhesion was intimate, and formed by means of a compact cellular tissue.

The heart was filled with coagula. Hypertrophy with dilatation of the right ventricle and auricle; the columnæ of the auricle were double the normal size. The thickened tricuspid valve formed a kind of narrow, fibro-cartilaginous ribbon, unable to close the orifice, which was a third larger than usual; the pulmonary valves were healthy.

Water poured into the aorta did not pass into the ventricle; the aortic valves, of about their normal form, were only a little shrunk and opaque, from their fibro-cartilaginous thickening; they had 5 times the normal thickness, and were slightly red on the free edge; the orifice not sensibly contracted. The left ventricle was of double the normal volume and weight, with dilatation of its cavity; its walls were about an inch thick. The two folds of the bicuspid valve were united at their commissure, so as to form a fibro-cartilaginous ring, with very thick lips, analogous to those of the glottis; with contraction of the corresponding orifice, which yet admitted the end of the little finger with ease. In its whole extent, the internal membrane of the left auricle was thickened, wrinkled, resembling "shagreen"; the muscular coat was about 3 lines thick.

The lungs offered nothing remarkable, but a serous or bloody congestion towards the dependent parts.

The reflections suggested by the preceding observation being, in a great measure, applicable to this, the reader is referred to it. In this also, we have the adhesions of the pericardium indicated, or at least suspected; the bicuspid contraction and insufficiency; the tricuspid insufficiency, with which we again see coinciding a souffle towards the inferior hollow of the sternum; finally, an aortic lesion without souffle in the carotids. As in the last observation, we attribute this anomaly to the reflux of the blood by the bicuspid orifice; without this circumstance, the souffle would doubtless have been prolonged to the carotids.

Observation 15th. — *Bicuspid and tricuspid contraction. Bicuspid insufficiency. Slight aortic thickening.* Julien Choisy, 49 years of age, lemonade-seller, was admitted the 29th of May, 1841.

Of moderately strong constitution, and lymphatic temperament, this patient, at the age of nine years, was affected with a general articular rheumatism, which lasted 5 or 6 months; at the age of 21, a new attack, of the same duration; in 1826, a third similar attack. Seven years ago, for the first time, paroxysms of suffocation and palpitations required several bleedings, and applications of leeches; 4 years ago, a new attack of rheumatism with palpitations, which lasted 5 months; since then, palpitation from time to time; most intense since 5 months, with dazzling of the eyes and giddiness; cough, for the last month; and, of late, slight œdema of the feet.

Present condition.—Countenance slightly pale and swelled; no ascites; no œdema of the lower extremities; heat moderate. The pulse 80, slightly unequal, but regular, moderately developed, not vibrating. The præcordial region presents a prominence of 4 or 5 degrees by the cyrtometer. The point of the heart beats in the 6th intercostal space, immediately under the breast; beatings are also perceptible in the inferior hollow of the sternum. The impulse is moderately strong, but quite extensive; the præcordial dulness being about 3 inches in each diameter; no vibratory thrill. The first sound is completely replaced by a rasping souffle, resembling a sharp, shrill cry; this souffle is heard in the whole præcordial region, but especially in the region of the left cavities, and auriculo-ventricular orifice. On ascending along the aorta, the souffle diminishes, and quickly disappears, to give place to a dull, heavy sound; it is not propagated into the carotids. The second sound, distinct in the præcordial region, consists in a harsh and dull sound, instead of a flapping, but without souffle. The jugulars are slightly distended; the dyspnœa is moderate in a state of rest. In the

respiratory apparatus is noticed only a slight subcrepitant râle behind, especially on the left side; with a slight, dry, crackling sound in front, and above the left breast, probably having its origin in the pleura.

The patient states that, a month ago, his habitual dyspnœa became so great as to require a bleeding, and that it was then accompanied with pain in the left side.

To what diagnosis do these different symptoms lead? Is there, in the first place, any indication, in the external appearance, of considerable obstruction to the *venous* circulation? There is puffy swelling of the face, slight distension of the jugulars, and a little pulmonary œdema; but neither ascites, nor infiltration of the extremities. We must, then, suppose a certain obstruction to the circulation of the *right* cavities, and, consequently, a certain *dilatation of the right auricle;* but not such considerable dilatation, as we have seen connected with tricuspid insufficiency, for example; here, then, is rather a slight, relative narrowness of this orifice. The beatings noticed in the inferior hollow of the sternum justify the opinion, that the right ventricle participates in the considerable hypertrophy of the heart in general.

As to the left cavities, in the region corresponding to them, and particularly in that of the bicuspid orifice, the most prominent sign is a rude, narrow souffle, predominating at the first time, and encroaching even upon the second, so as to hinder the perception of the valvular flapping; this last is the more distinct as the aortic region is approached, but with a hard and dull tone. Can we mistake, here, a bicuspid insufficiency, with a certain narrowness of this orifice; and, at the same time, a certain thickening of the aortic valves, which does not oppose their closure (for they are not insufficient), but which obscures their flapping; a thickening, which may partly cause the souffle at the first time, but only to a slight degree, since the souffle is not prolonged to the carotids; the orifice being besides opened to such an extent, that the

column of blood, slightly diminished by the bicuspid insufficiency, produces a radial pulsation, vibrating, and slightly unequal, but still considerably developed?

But what is the *dull and heavy sound,* which, along the aorta, is by degrees disengaged in proportion as the *souffle of the first time diminishes?* It is the imperfect flapping of the *bicuspid* valve, which, slightly insufficient, has not entirely lost its play; and to which is added the more distant, and doubtless modified, flapping of the *tricuspid* valve. Besides, we have no vibratory thrill; hence neither vegetations, nor cretaceous state of the orifices, or aorta.

The diagnosis of M. Bouillaud, at the bedside, was as follows:—*General hypertrophy of the heart,* (about 15 ounces). *Thickening, induration, and deformation of the left valves, especially of the bicuspid, with contraction of the corresponding orifice.*

The patient died on the 15th of June, with nothing new in the local symptoms.

Autopsy. — The cardiac surface of the pericardium presented numerous plates, the three principal of which were situated at the base of the right ventricle, at the base of the left, and towards the summit of the latter; these 3 plates stood out in decided relief. The heart was generally and considerably hypertrophied, especially the left cavities; all its cavities contained fibrinous concretions, many of them formed before death. Freed from coagula, and after 5 hours maceration in water, the heart weighed about 19 ounces; its weight was evidently increased by the maceration.

Right side. — The auricle was sensibly dilated; firm, and vermilion-red in its tissue. The circumference of the tricuspid orifice was only 4 inches (instead of $4\frac{1}{2}$); its valve was thickened, and towards the pulmonary artery, slightly adherent to the corresponding part of the ventricle. This last was slightly dilated, both relatively and absolutely; its maximum thickness was 5 lines. The pulmonary valves were well

formed, only a little stronger than natural ; the corresponding orifice was $3\frac{2}{5}$ inches in circumference.

Left side. — Water poured into the aorta did not penetrate into the ventricle ; the calibre of this vessel normal. At its origin, and on the internal surface, there were a few rudiments of cretaceous matter, without sensible projection. The sigmoid valves, perfectly formed, were firm and sensibly thickened, without having completely lost their transparency ; the aortic orifice $3\frac{1}{5}$ inches in circumference. The left ventricle, the essential seat of the hypertrophy, was evidently increased in capacity ; it would have contained an egg ; its walls were thickened, being an inch thick at the base, and three-fourths of an inch towards the apex, which was dull and rounded. The auricle was also large ; its tissue fleshy and vermilion-red ; the circumference of its orifice was $3\frac{3}{4}$ inches, instead of 4. The valve, thicker than the others, was fibro-cartilaginous, creaking under the scalpel, and besides adherent to the ventricle by a part of the internal face of its free edge, and especially in a third of its extent ; it was, then, insufficient ; the two columnæ attached to it were strong, and terminated by large tendons.

The lungs presented a slight serous engorgement at their posterior parts.

We were mistaken, in taking for a pleural friction, what was, doubtless, due to the pericardiac plates above mentioned. This error might have easily been avoided, had it not been for the patient's dyspnœa, which, though moderate, did not permit a complete or prolonged suspension of the respiration ; and if the sound in question, in part masked by the souffle, had been more persistent ; this depending, perhaps, on the inequality of the ventricular contractions, as shown by the unequal pulse.

With this exception of an accessory phenomenon, and as far as concerns the orifices of the heart, did not the autopsy confirm the diagnosis ?

There was here a tricuspid lesion, without souffle in the inferior hollow of the sternum; this negative fact may be contrasted with the opposite ones of two of the former observations.

Observation 16th. — *Narrowness of the two orifices Bicuspid vegetations, and cretaceous concretion of the aortic valves.* Auguste Camuset, 16 years of age, was admitted to the hospital, the 21st of May, 1841.

This young patient, of delicate constitution and lymphatic temperament, has formerly enjoyed good health. A year ago, he had a general articular rheumatism, which confined him to his bed 2 or 3 months, since which time he has been subject to pain in the joints from time to time; and for 3 months, more particularly, to palpitations, dyspnœa, and several symptoms of cerebral congestion. Finally, for some time, there has been infiltration of the lower extremities, extending even to the trunk.

Present condition. — Slight puffiness of the face; infiltration of the feet and lower part of the legs; infiltration of the scrotum, with general swelling and transparency, at first sight simulating a hydrocele. The skin of the trunk slightly hot, 100°. The pulse 136, small, but distinct, a little vibrating, and regular. General, ill-defined præcordial prominence; in this region are perceived beatings, extending even to the inferior hollow of the sternum. The apex raises the 6th intercostal space, a little to the outside of the breast; its beatings are strong, remarkable for their extent, accompanied by a kind of dull and distant thrill, propagated along the ascending aorta; the dulness is about 3 inches in each diameter.

On applying the ear to the præcordial region, it is struck with the extraordinary intensity of a souffle, resembling at once the sound of a rasp and a jet of steam, double, extending to the right and left of the breast, propagated even under the left clavicle, and ceasing to mask the second sound only

under the right clavicle; there only, in fact, is heard the flapping of the second time, hard, dry, essentially parchment-like, analogous to a quick fillip. The souffle of the first time, distinguishable in this region, is feebly propagated into the carotids; these arteries, and especially the right subclavian, beat with force and visibly; the jugulars are evidently distended. No souffle distinguishable in the cœliac trunk, abdominal aorta, or crurals, the sound of the last resembling a distinct fillip. The respiration obstructed, indicating slight pain, at 44 to 48; only a slight, disseminated, subcrepitant râle.

On the morrow, M. Bouillaud verified these symptoms and signs; he added, that the præcordial souffle might be heard at the distance of 2 inches from the chest, as a slight cry, which, on immediate application of the ear, is effaced by the roughness of the souffle. As on the preceding evening, the second sound is only disengaged towards the right clavicle, as a parchment-like flapping, slightly masked; the first sound being completely masked by the souffle. At the back of the chest, on both sides, the double souffle was heard with distinctness, completely masking the two normal flappings.

From these signs, what should be the diagnosis?

As in the preceding observation, there is reason to admit a stagnation of the venous blood, and a moderate dilatation of the right auricle. As to the left orifices, they are both evidently affected. A souffle so intense, double, and without flapping sound in so large an extent, excludes the idea of a single lesion; still, a slight flapping is heard at the second time under the right clavicle, and the souffle of the first is propagated but feebly to the carotids. The principal seat, then, of this enormous souffle is not the orifice of the aorta, whose valves, doubtless thickened and parchment-like, have not lost all their flapping. We admit, then, that if the two valves are insufficient, at least the bicuspid is more so than the aortic, since there are slight traces of aortic flapping,

while there is not the smallest sign of the bicuspid in any part.

But the souffle presents a certain degree of *narrowness;* it becomes *whistling;* therefore, one of the orifices is, doubtless, *very narrow.* Which is it? We have just admitted that the insufficiency, that is, the enlargement, predominates at the bicuspid orifice; we must attribute, then, the narrowness to the aortic.

Finally, there is a deep-seated, distant vibratory thrill, but also propagated along the ascending aorta; a reason for supposing, either vegetations, or a cretaceous state, of the two valves perhaps, but more particularly of the aortic.

The diagnosis of M. Bouillaud was quite minute; it was dictated at the bed-side, as follows: —

General hypertrophy of the heart. Thickening, hypertrophy, and probably vegetations, of the left valves. Narrowness of the orifices, especially in relation to the volume of the heart, and the capacity of the left cavities. Dilatation of the right auriculo-ventricular orifice, and perhaps insufficiency of its valve.

The following days, the signs persisted. On the 24th of May, the souffle resembled the cry of a young chicken, mingled also with a rasping souffle, and a profound vibratory thrill. The 27th, the thrill was still more pronounced, and the pulse vibrating, but at the same time small and soft. The infiltration of the limbs, scrotum, and abdomen made continual progress; the oppression was extreme. Death on the 31st.

Autopsy. — The heart, freed from coagula, weighed only 9 ounces. (The heat being very great, this small number may have depended on the transudation of the fluids.) It was, however, generally hypertrophied, especially the left cavities. The right auricle was dilated: its valve, slightly thickened, was $4\frac{3}{4}$ inches in circumference. The maximum thickness of the walls of the right ventricle was about 3 lines.

The left ventricle was, on the contrary, evidently dilated; it would have contained a pullet's egg; its tissue was firm and resisting. Its walls were, at the maximum, three-fourths of an inch thick; its columnæ strong in proportion.

The bicuspid orifice presented an extent of $3\frac{3}{4}$ inches. Its valve was moderately thickened; on its surface, in an extent of about an inch, there was a group of small vegetations, still fibrinous, and strongly adherent; others, quite numerous, were attached to the chordæ tendineæ of the valve.

The aortic orifice was small and very narrow, both absolutely and relatively to the capacity of the ventricle; its valves were evidently thickened. Two of them, the nearest to the auricle, gave insertion to a globular mass, of the volume of a large filbert, evidently composed of fibrinous granulations, successively deposited around a central nucleus, by a kind of organic crystallization. This mass, in which were some grains as hard as gravel, projected about 5 lines into the ventricle, being deposited, and, as it were, grafted upon the ventricular face of the valves, and on their free edge. There were but traces of the valves remaining; they were retracted and confounded, except at their adherent border, with this mass; on the aortic surface they were distinguishable, as here the fibro-calcareous mass was not inserted.

With the exception of this curious aortic concretion, which was indicated even under the name of vegetations, is it possible for diagnosis to be more exact? Is it said, that the tricuspid orifice was not dilated, because its circumference was only $4\frac{3}{4}$ inches, that is to say, three lines more than normally? It may be answered, that the question is here of a heart of 16 years; of a heart, which, hypertrophied as it was, weighed, not 16 or 20 ounces, but only 9; of a heart, finally, whose right cavities were not the predominant seats of the hypertrophy; the normal difference between the two auricular orifices being represented by 1, the difference was

here $2\frac{1}{2}$; so that either the tricuspid was much dilated, or the bicuspid much contracted. The tricuspid valve may not have been insufficient, but this was only indicated in a doubtful manner. As to the left orifices, their narrowness is too evident, to need any discussion.

Now that we know all the lesions of this heart, is it necessary to return to its morbid sounds, and analyze their mechanism, and value as symptoms? Who does not at once see that the *double souffle* had its cause, at the same time, in *both of the left orifices;* that is to say, in the collision of the current of blood against both the bicuspid vegetations, and the aortic concretions: that the cause of the whistling cry was both in the narrowness of the bicuspid orifice, incompletely closed, perhaps by a valve whose play was obstructed by vegetations, and especially in the smallness of the passage left for the column of blood by the deformed state of the aortic valves: that the souffle of the first time was propagated, but feebly, into the carotids, because the state of the aortic valves was but one of the elements in its production; the bicuspid orifice, and perhaps the tricuspid insufficiency, contributing to its formation: that the souffle was equal at both times, because there was at each orifice an anatomical state almost identical, vegetatious at the one, cretaceous condition of the other; on the one hand, the first souffle having for its causes the aortic narrowness, the bicuspid, and, perhaps, the tricuspid insufficiency; and on the other, the second souffle being produced both by the (probable) partial insufficiency of the aortic valves, and, especially, by the collision of the blood against the bicuspid vegetations? Who does not see, finally, that if, at a distance from the heart, was heard a slight flapping at the second time, this flapping was due partly to the aortic valves, yet perhaps slightly movable, but more particularly to the normal valves of the pulmonary artery?

But enough for this observation, which, although appa-

rently a little more complex than the preceding, is none the less susceptible of a rigorous and positive analysis.

Observation 17th. — *Bicuspid narrowness. Aortic insufficiency.* A patient, of 48 years, was admitted into the hospital, the 8th of December, 1841. He was sent, as having been attacked, about 12 days ago, with a pneumonia, ineffectually treated by quickly repeated bleedings (coup sur coup). The examination of this patient did not confirm the above diagnosis; and what was most positive, in our opinion, was the unfavorable result of a very active treatment (five bleedings in four days, twenty-five leeches, and two blisters) against an affection at least doubtful. In fact, the patient, of an enfeebled constitution, presented all the characters of complete anæmia, general paleness, and extreme feebleness; a respiration certainly rapid, difficult, and expressive of pain; but a resonance everywhere good, and no morbid sounds, except a disseminated râle, rather bronchial, than vesicular. As to his former diseases, they appeared to have consisted chiefly in an intermittent fever, of above a year's duration, with which he was attacked in 1814, and an inflammation of the chest, in 1821.

After the examination of the respiratory apparatus, the results of which have been given above, we examined the circulating system, and found the following signs: —

The pulse 88, exceedingly soft and compressible, hardly striking the finger, unequal, and almost imperceptible at times. The præcordial dulness is of an extent one-third greater than normally; no vibratory thrill. The impulse is profound; the beatings hardly perceptible to the touch; consequently, the sounds are feeble, difficult to seize, as the patient cannot suspend or lessen his respirations without great difficulty. Still, we distinguished on his entrance, and M. Bouillaud on the morrow, a souffle, double in the aortic region, single in the left auriculo-ventricular, existing here at the second time, and somewhat sharp; no "bruit de

diable" at present; but distinct propagation of the aortic souffle.

The diagnosis of this affection of the heart is so easy, that it is hardly necessary to indicate it in advance.

Preoccupied by the respiratory apparatus of the patient, and justly indignant at seeing compromised in this manner his method of bleeding, "coup sur coup,"[1] (a method really precious for a skilful physician, but dangerous in unskilful hands,) M. Bouillaud contented himself with dictating in his diagnosis, "*organic affection of the heart, especially of the left valves.*"

As to ourselves, whom the nature of our evening lessons obliged to be more minute, we added to this diagnosis: *deformation of the two orifices, and more particularly the aortic; insufficiency of the aortic valves; sufficiency of the bicuspid.*

It is easy to explain the reasons of this diagnosis in a few words. There was a souffle, at the first time, in the region of the aortic orifice, propagated to the carotids; this orifice is, then, incompletely opened; but this souffle is also reproduced at the second time; this orifice is, then, also incompletely closed. There is a souffle in the bicuspid region, and this souffle, single at this point, exists only at the second time; hence, this orifice may be sufficiently closed, but it is certainly incompletely opened. We ought to have concluded from the character of this souffle, that the orifice was remarkably contracted; and if, instead of deformation, we had said narrowness of the bicuspid orifice, the diagnosis would have been completely conformable to the autopsy; this took place the 12th of December, four days after his entrance.

Autopsy.—The lungs offered nothing remarkable, but old adhesions, engorgement of the posterior portions, slight red-

[1] Dr. Bartlett has well translated this, "dash upon dash." On typhoid fever.

ness of the bronchial tubes, and the part of the left lung, in the neighborhood of the præcordial region, emphysematous in an extent of about two inches, in each direction. The heart was distended by coagula, in part recent, in part formed before death; freed from these, it weighed eighteen ounces.

Right side. — The pulmonary artery offered nothing remarkable; its valves were sound; the circumference of its orifice a little more than three inches. The ventricle was slightly dilated; its walls were hardly three lines thick. The auricle, on the contrary, was considerably dilated; its valve thin; the circumference of its orifice five inches.

Left side. — The auricle, like the right, would have contained a moderately-sized orange; its valve was sensibly thickened, but free, without adhesions, and well-formed; the circumference of its orifice being only four inches. The walls of the ventricle, towards the base, were three-fourths of an inch thick; its cavity was considerably augmented; largely opened, it presented, transversely, an extent of nearly eight inches. The aorta was sensibly dilated at its arch; it presented, on its interior, a rough, unequal surface, studded with cretaceous plates, which extended even into the descending portion. The valves were thick, almost fibrous, adherent by their borders, swelled at their free edge, and evidently insufficient; for water poured into the aorta penetrated immediately into the ventricle; the circumference of its orifice was $3\frac{1}{3}$ inches.

This autopsy fully confirms the diagnosis, as regards the left orifices; but there were two elements omitted, from the absence of the signs which we have hitherto seen accompanying them; we mean, on the one hand, the notable dilatation of the right auricle and the corresponding orifice, and, on the other, the cretaceous state of the aorta. In fact, this last lesion was announced neither by a vibratory thrill, nor by the intensity or roughness of a rasping souffle, prolonged

in the course of the aorta ; for these signs suppose a vigor in the contractions of the left ventricle, incompatible with the feebleness and anæmia of the patient. But how explain why the dilatation of the right auricle did not cause any of the serous infiltrations, which the preceding observations have offered ? This, we confess, is more difficult to explain. But these two morbid elements, revealed by the autopsy, are not at all incompatible with the stethoscopic signs noticed during life ; they are only two conditions more to add to those above mentioned, as causes of the souffles of the first and second times.

The following observation was obtained under the dictation of M. Bouillaud, when we commenced following his visits.

Observation 18th. — *Narrowness and insufficiency of the left valves. Cretaceous state of the bicuspid valve. Adhesions in the pericardium.* John Hans, 28 years of age, cabinet-maker, entered the hospital, the 13th of December, 1836.

This patient, of feeble constitution, and lymphatico-sanguine temperament, had had two attacks of rheumatism, and a bronchial affection accompanied with spitting of blood.

Condition at entrance. — Slight præcordial prominence ; dulness of more than 5 inches, both transversely and vertically. A double souffle accompanied the two sounds, but particularly the second. The first was a rough, short sound, heard most distinctly in the region of the left auriculo-ventricular orifice. The second was a prolonged souffle, like a jet of steam escaping from a valve ; it corresponded especially to the sternal region of the aorta. Notwithstanding the general weakness, the pulse was slightly vibrating ; it was regular, moderately developed. No infiltration of the legs.

M. Bouillaud dictated the following diagnosis : — *Enormous hypertrophy of the heart, with thickening and insufficiency of the left valves.*

The 28th, a distinct vibratory thrill was noticed below the

breast; and a peculiar scraping sound, which led M. Bouillaud to suspect that the pericardium was affected.

The patient left the hospital on the 6th of January, slightly relieved, but reëntered on the 15th of February, with a painful bronchitis, with fever. The souffles were the same; M. Bouillaud continued to believe that pericardiac friction was mingled with them.

Nothing important was observed during the following weeks, except, in the beginning of March, a slight puffiness of the face; a pulse always small, disproportioned to the force of the heart's beatings, but each pulsation distinct, and offering a slight vibratory thrill. Towards the aortic orifice, and in the course of this vessel, the souffle of the first time was mingled with a suppressed flapping; the second souffle was unmixed, and as if by aspiration. On the 19th of May, there was swelling of the legs, with commencing swelling of the thighs; the two sounds of the heart resembled the sound of a saw. On the 22d, a double souffle was heard in the bicuspid region, and there masked completely the valvular flapping; in the region of the aortic orifice, and on ascending towards the aorta, the souffle predominated always at the second time, the first being mingled with a slight flapping. The vibratory thrill corresponded especially to the bicuspid orifice.

M. Bouillaud thought there was *considerable contraction of the left auriculo-ventricular orifice, and insufficiency of the aortic valves.*

The following days, there arose great oppression; then puffy swelling of the cheeks and lips, œdema of the superior extremities, and diarrhœa; finally, death took place on the 29th of May.

Autopsy, dictated by M. Bouillaud. The pericardium was uncovered in an extent of $5\frac{4}{5}$ inches transversely, and about $6\frac{2}{5}$ vertically; the two surfaces of the pericardium adhered, in their whole extent, by a well-organized, firm, cellular tis-

sue. The heart, freed from coagula which distended it, and washed, weighed 21 ounces. The hypertrophy and dilatation occupied all the cavities.

The orifice of the pulmonary artery was free, a little dilated; its circumference was $3\frac{3}{4}$ inches; its valves were thickened, especially at their free edge, and opaline at their base. The cavity of the right ventricle was a third larger than usual; the same was the case with the right auricle, whose walls were 5 lines thick near the ventricle, (instead of about 1 line). The tricuspid valve was well-formed, but of triple the normal thickness, and fibro-cartilaginous; the circumference of the orifice was $5\frac{1}{2}$ inches. The tricuspid valve, as well as the pulmonary, was not insufficient.

When water was poured into the aorta, a little penetrated into the ventricle. The aortic orifice was $2\frac{3}{4}$ inches in circumference; the valves, which had become linear, formed a kind of fibro-cartilaginous fold, rigid, 4 lines deep, instead of about 8. The cavity of the left ventricle was not so large as the right, but larger than usual; the walls, towards the base, were three-fifths of an inch thick. The left auricle was dilated and thickened; its lining membrane opaline, and composed of several laminæ. The left auriculo-ventricular orifice would hardly admit the end of the ring-finger. The two folds of the valve were united so as to form a ring, and transformed into a fibro-cartilaginous tissue; their surface was roughened, on both sides, by calcareous and horny concretions, some of which projected 3 lines, being suspended like stalactites; towards the auricle, the right fold of the valve was almost entirely transformed into a calcareous concretion, friable, and very hard to the touch; the tendinous chords were thickened and shortened; and the summits of the columnæ carneæ were transformed into a tendinous tissue. The thoracic aorta was perfectly healthy.

Is not this autopsy the complete verification of the diagnosis? Adhesions in the pericardium were suspected and were

found ; bicuspid contraction and aortic insufficiency were indicated, and both existed. Even at the risk of making a useless repetition, we will compare the physical signs with the lesions.

Souffle at the first time : narrowness of the aortic orifice, and bicuspid insufficiency.

Souffle at the second time : bicuspid narrowness, and aortic insufficiency.

In recollecting the narrowness of the two orifices, the character of the souffles is easily explained; this double sawing sound, this jet of steam, this sound of aspiration at the second time, in the aortic region. In recollecting, also, the cretaceous state of the bicuspid valve, the rasping sound, frequently heard, is at once understood.

In the aortic region, the souffle of the first time was diminished, because there it was produced only by the aortic narrowness, that arising from the bicuspid insufficiency being, doubtless, too feeble to reach the ear ; the second, on the contrary, predominated, because it was produced, both by the narrowness and cretaceous state of the bicuspid (whose louder sound ought to reach the ear) and the insufficiency of the aortic orifice. This second souffle was strong enough to mask all flapping, and to prevent that of the pulmonary valves from being heard ; the first souffle, weaker, allowed, on the contrary, to be distinguished, but obscure and distant, the flapping of the tricuspid orifice, whose valve, though dilated, was not insufficient.

Finally, from our former observations, with the exception of the last, the *infiltration* noticed during life, justified us in supposing a notable *dilatation of the right auricle ;* and this lesion was found.

Observation 19th. — *Coagula in the heart. Considerable dilatation of the right cavities — aortic vegetations — bicuspid narrowness.* Bouillon, 41 years of age, brewer, was admitted the 2d of March, 1838.

This man, of strong constitution, and formerly enjoying good health, declared that he had had no diseases but three attacks of rheumatism, the last and most severe of which happened 18 months ago. For the first time, 11 months ago, he was affected with dyspnœa and palpitations; since nine months has been added a slight swelling of the feet, which disappeared, returned, and has persisted for the last two months. For a few days past, he has been subject to a very great dyspnœa; he has had several attacks of faintness, with complete loss of consciousness.

Present condition. — He is seated on the edge of his bed, his feet supported on a chair. The respiration panting, 40 to 44; the face of a paleness slightly livid: the lips large, and a little violet-colored; the eyes prominent; the jugulars distended, especially in expiration; the lower extremities greatly infiltrated; the extremities slightly cold. The præcordial region, more prominent than the other side, is traversed by several venous trunks; the beatings of the heart more extensive than normally, but embarrassed, as if the organ found itself confined in a narrow space. Its point is felt $2\frac{1}{2}$ inches below the breast, and quite to the outside, so that it is situated transversely; the dulness is $4\frac{3}{4}$ inches vertically, and about 6 transversely; the hand feels a slight thrill.

In the region of the left cavities, a double rasping or sawing sound completely replaces the valvular tic-tac, and is heard in the whole præcordial region and neighborhood; the souffle is strongest and most prolonged at the first time. The pulse is small, very difficult to feel on the left side, more distinct on the right, irregular, unequal, and intermittent; 124 pulsations may be counted; some of which are imperceptible from their smallness; others are slightly vibrating. The beatings of the heart seem less unequal, and less irregular than the pulse.

From these signs, M. Bouillaud indicated: *enormous hypertrophy of the heart. Thickening, induration, and insuf-*

ficiency of the left valves especially. Coagula in the heart.

From the detailed diagnosis of the preceding observations, it may appear strange to find so little precision in this; but the last element of the diagnosis is sufficient reason for this want of localization for any one accustomed to the auscultation of the heart. Indeed, when the blood coagulates in the cavities of the heart, there results not less disorder in the normal, or morbid sounds, than derangement of its functions; and as this is the first time that we have noticed these concretions, we will briefly state what led to their admission in this case.

It should be remarked, in the first place, that this patient presented the most intense orthopnœa, that we had then met with. This panting, the anxious countenance, the distension of the jugulars, all the signs, in fact, of a considerable obstruction to the venous circulation; the long duration of these morbid phenomena; the prolongation of this stagnation of the venous blood; did not these constitute a reason for supposing that coagulation was necessary for such obstruction of the course of the blood? But to arrive at more precise indications; these were furnished by the obstructed movements of the heart, which, though extensive, seemed, according to M. Bouillaud's expression, to be confined in a narrow space; besides, the inequality and irregularity of the beatings; the character of the pulse, generally small; sometimes imperceptible; sometimes, on the contrary, almost vibrating; the pulse more unequal and irregular than the heart itself, since, between the radial pulsation and impulse of the left ventricle, independently of the organic lesions of the valves themselves, were found other obstacles, sometimes fixed, but often movable, breaking, or intercepting, more or less completely, the efforts of the column of blood.

These are the principal signs of coagula in the heart; signs very important to know, as they often will explain

functional disorders, otherwise inexplicable, and, at the same time, suggest an active, vigorous treatment, frequently as powerful against these transient affections, as, unfortunately, powerless against organic lesions of the heart, properly so called.

To return to our patient. The following days, there was slight relief under the influence of a bleeding and digitalis, but the infiltration made new progress; the scrotum and penis became œdematous; the peritoneal cavity was filled with serosity; the pulse remained small, and became more and more imperceptible; the sounds of the heart, always accompanied by a double souffle, became duller and more indistinct; the dyspnœa reappeared, so fearfully violent, that the patient, almost upright in his bed, begged the attendants to strangle him, to terminate his sufferings; finally, on the 27th, death put an end to this frightful agony.

Autopsy. — The pericardium was uncovered in an extent of seven inches transversely; it contained about two ounces of a serosity, slightly troubled. The heart, whose point was turned almost directly to the left, was distended by coagula to double its normal size; these coagula were partly soft, partly discolored, and half-organized. Freed from these concretions, the heart weighed, with the origin of the large vessels, $21\frac{1}{2}$ ounces.

The right ventricle would have contained the fist; it was hypertrophied in proportion to its dilatation — the maximum thickness of its walls was 5 lines. The right auricle was dilated and thickened in the same proportion; the tricuspid orifice was about 6 inches in circumference; the valve presented its normal conformation; it was thickened, hypertrophied, nearly sufficient. The valves of the pulmonary artery were thin, and wider than normally; the circumference of the orifice was 4 inches.

The left ventricle would have held a large duck's-egg; its walls were about three-fourths of an inch thick, and, what is

somewhat remarkable, were much less firm, and less deeply red than those of the right ventricle. Water poured into the aorta closed the valves, and did not penetrate into the ventricle; the valves were well-formed, but thickened; their free edge was roughened by small granular vegetations, towards the ventricle, organized, resembling venereal warts; the circumference of the orifice was $3\frac{1}{2}$ inches. The mitral valve was considerably thickened, and transformed into a fibro-cartilaginous tissue; the orifice only admitted the ends of two fingers; its circumference was $3\frac{1}{2}$ inches; towards the auricle, the thickened valve formed a kind of puckered fold, like the skin of the anus; the edge, to which were attached the tendons, presented small vegetations, but less numerous. The walls of the left auricle were thickened in proportion to the ventricle; its lining membrane offered a slightly areolar and thickened appearance.

Our former remarks will answer as comments upon this autopsy. It may be easily conceived that had it not been for these coagula, the effects of which we have noted, it would have been as possible in this, as in our former observations, to determine this remarkable narrowness of the bicuspid orifice, and these vegetations of the aortic valves, the cause of the vibratory thrill, their insufficiency, and perhaps even this insufficiency and enormous dilatation of the tricuspid orifice and corresponding auricle, coinciding here again with considerable infiltration, and with œdema of the lungs, which was noted in the autopsy, but which we have given only as it regards the heart.

We have seen, in this observation, an example of these sanguineous concretions, fixed, persistent, and remaining after death; we shall see, in the following, temporary concretions; it will be a useful addition to the preceding facts.

Observation 20th.—*Temporary coagula. Bicuspid narrowness, and slight insufficiency. Slight aortic thickening.* Frederic Piquois, 36 years of age, founder, entered the hospital the 23d of December, 1841.

This patient, of strong constitution and lymphatic temperament, had formerly enjoyed good health ; he had been only subject, for 8 or 10 years, to head-ache, and a feeling of dulness. A year ago, was added cough, difficulty of breathing on ascending a height ; œdema, at first limited to the left cheek, afterwards extending to the superior, and then inferior extremity of the same side ; and, since six weeks, to the right lower extremity ; finally, vomiting, more frequent of late. These symptoms obliged him to leave off work, six months since, and since frequently to keep his bed.

Present condition.—The face, the trunk, the left fore arm and wrist, and the two inferior extremities present a state of evident puffy swelling ; the lower extremities, in particular, preserve the impression of the finger ; the skin is generally pale. Nausea at intervals ; the epigastrium and abdomen without pain ; no pain in the region of the kidneys ; urine scanty ; the penis slightly œdematous ; the heat of the skin moderate ; the pulse 120 – 124, rapid, unequal, hardly perceptible, contracting by its smallness with the strength of the patient. The præcordial region presents a prominence of about 4 degrees ; but the walls of the chest, especially of the left side, are somewhat infiltrated ; from this circumstance, doubtless, the point of the heart is found with difficulty, and its beatings are irregular ; they may, however, be perceived in the 6th intercostal space, about an inch outside of the nipple. As to the beatings of the heart itself, the hand, firmly applied, hardly feels them, and without apparent vibratory thrill ; the dulness is about 3 inches vertically, and $3\frac{1}{2}$ transversely. On auscultation, the first sound is effaced, as it were, while the second is drier than normally ; in the region of the aorta and its orifice, this contrast is at its maximum, the second sound being there hard, and parchment-like ; in the region of the left auriculo-ventricular ori ice, there is the same absence of the first flapping, the clearness of the second being less sensible ; and besides, at intervals,

a slight, rough souffle mingled either with the first or second time; no propagation of this souffle into the carotids. No visible distension of the jugulars. The respiration is obstructed, difficult to suspend, 28 in a minute; a slight subcrepitant râle at the inferior and posterior portion of the left lung.

On the 24th, M. Bouillaud observed as follows: The pulse is 124, difficult to feel, rapid, but without irregularity at present. As yesterday, the point of the heart beats obscurely in the 6th intercostal space, a little to the outside of the nipple; as yesterday, the first flapping is effaced, replaced by a souffle; the second is rough, parchment-like, without present souffle. The souffle disappears as you depart from the left auriculo-ventricular orifice; and, towards the clavicle, a single sound only is heard, corresponding to the second time.

M. Bouillaud dictated the following diagnosis: *Considerable hypertrophy of the heart* (14 to 16 ounces). *Induration and thickening of the left valves, with deformation of the bicuspid valve, and contraction of the corresponding orifice.*

In this diagnosis, M. Bouillaud evidently formed his opinion both from the signs noticed by himself, and those noticed by us the evening before. The first flapping was effaced, replaced by a souffle, which grew weaker in proportion to the distance from the bicuspid orifice; hence this valve was deformed, and even slightly insufficient. In this same region there was not, then, any souffle at the second time; but we had noticed one in the evening; hence, there might be a certain contraction of this orifice, a lesion often coexisting with the deformation and insufficiency of a valve.

Was this diagnosis final, and did it give the key to all the symptoms observed? Certainly not.

The dyspnœa; the general infiltration; the irregularity of the beatings, observed at intervals; the smallness, and, espe-

cially, the rapidity of the pulse (124) certainly indicated a considerable obstruction to the venous circulation. But what was this obstacle? Perhaps a lesion of the right ventricle; perhaps, also, sanguineous concretions; certain signs, noticed afterwards, decided this question. Besides, the anasarca did not follow, in this case, the usual march; it appears to have commenced by the face, the lower extremities being affected only of late; was not this a reason for supposing that there existed here, as complication of the disease of the heart, and as essential cause of the serous infiltration of the limbs and trunk, the affection of the kidneys, called Bright's disease? To determine this question, the patient was told to preserve his urine. On the morrow, this liquid was seen, pale, opaline, slightly acid, and frothy, furnishing a white precipitate on the addition of nitric acid, and from heat, taking the consistence of syrup; the patient had vomited several times. Albuminuria was added to the diagnosis.

These phenomena, and especially the vomiting, persisted almost continually till death, which they doubtless concurred in producing; but the sounds of the heart offered an important modification.

On the 30th and 31st, M. Bouillaud, on ausculting the præcordial region, was astonished to find the two sounds of the heart well marked, especially the second, always with a slight parchment-like sound, and loud; the first being only a little rude; besides, there was no souffle, unless a very light one at the first time, in the aortic region especially. The point of the heart had remounted to the 5th intercostal space. There was no oppression in a state of repose; the swelling of the limbs diminished; we will add, for this is essential, that the pulse had fallen to 60.

This is of great importance; for it leaves no doubt that the morbid phenomena, noticed on the patient's entrance, depended on coagula, which had, among others, this triple effect: 1st, to distend the heart to such an extent that the

apex descended to the 6th intercostal space; 2d, to obstruct the valvular play, and efface the flapping, of the bicuspid valve, much more exposed to their contact than the aortic valves, on account of its conformation and more central situation; 3d, to determine, in the ventricular contractions, and consequently in the current of blood, an increased quickness, a condition so favorable (here, perhaps essential) of the excess of friction supposed by every souffle.

M. Bouillaud completed his diagnosis, by adding: *Probability of temporary polypiform concretions in the cavities of the heart.*

But it is said, if these coagula are once admitted as the cause of the phenomena noticed on the first days, and which have since disappeared, what becomes of the first diagnosis, relative to the bicuspid and aortic valves? We still maintain our former opinion; because, if it be true that the souffles have disappeared, except that of the first time, which may perhaps be considered a souffle of anæmia, it is none the less true that the valvular sounds have not become normal; the first is still a little rude, and the second parchment-like; hence, the corresponding valves are not healthy. If a more convincing proof be desired, it will be found in the course of the observation.

The 14th of February, the swelling had made new progress; the pulse had risen to 92; a very distinct, rasping souffle was heard at the first time. On the 23d, the infiltration was considerable, to which ascites was added; the pulse 88; the rasping souffle persisted.

To render the demonstration complete, let us submit the diagnosis to the test of the autopsy, which took place on the 4th of March. The preceding remarks preclude the necessity of long comments, and we shall, therefore, simply expose the lesions.

Autopsy. — Considerable infiltration of the limbs and trunk.

Thoracic cavity. — Very evident serous engorgement of both lungs, especially the left. The heart hypertrophied, but moderately; it weighed, with the origin of the large vessels, about 15 ounces; the hypertrophy affected more particularly the left ventricle. The pulmonary and tricuspid orifices, and the right ventricle offered nothing remarkable.

The left ventricle was enlarged, and its thickness, from the base almost to the apex, was three-fourths of an inch. Its columnæ carneæ, quite strong, were attached by tendons somewhat short, to a bicuspid valve sensibly thickened at its free edge, and seemingly more contracted and narrow than normally; in fact, the circumference of the orifice was only $3\frac{2}{5}$, instead of a little more than 4 inches.

The circumference of the aortic orifice was about 3 inches; its valves well formed, and sufficient, as was proved by pouring water into the vessel; they offered only a kind of small, fibrinous ring towards their base; and above their free edge, the internal membrane of the aorta presented a line, almost circular, of a nankin yellow, contrasting more by its color, than its feeble relief, with the smooth, polished surface of the membrane.

Abdominal cavity. — The kidneys were both remarkably small, not larger than those of a child; their vertical diameter was about 4, and their semi-circumference $2\frac{2}{5}$ inches; the two weighed, with their fibrous capsule, and a portion of the ureter about $4\frac{1}{2}$ inches long, about 6 ounces; the weight of each was about the same. Internally, they offered nothing remarkable; but externally, they were granular, red, adherent to the capsule, which, in many points, could only be removed by tearing it. This alteration only occupied the surface of the organ, which, at the depth of half a line, seemed to have its normal texture. The ureters and the bladder were remarkably pale. The urine contained in the bladder was carefully collected, and treated with nitric acid,

when, instantly, a very abundant white precipitate was obtained.

We shall finish this series of analyses, already perhaps too long, by an observation, interesting, less from the anatomical lesions, which are the same as we have often noticed before, than from the existence of a symptom which we have not as yet met with, the triple and quadruple sound ; we shall see, also, death caused by a coagulum in the heart. It is a new feature in the history of this morbid product ; and is also a point of contact between this and the preceding observations. This observation we obtained from the dictation of M. Bouillaud, before we entered his clinical service.

Observation 21st. — *Narrowness, insufficiency, and calcareous state of the bicuspid valve. Hypertrophy of the left auricle. Triple sound. Death from a coagulum.* Garret, butler, 38 years of age, entered the hospital the 4th of January, 1838.

This patient, of delicate constitution, and lymphatico-nervous temperament, had uniformly enjoyed good health ; he had suffered from palpitations since a year only, and nothing in his previous life explained an organic affection of the heart. The articulation of the left shoulder presented a state of semi-ankylosis, with a cicatrix towards the middle of the arm, which appeared to have been the sequela of a violent phlegmonous inflammation, 12 or 13 years ago ; the limb was slightly atrophied. He ascribed the commencement of his palpitations to a thoracic affection, which had lasted 5 weeks.

Present condition. — The countenance expresses fatigue, and is pale, as well as the rest of his body ; there is neither œdema of the limbs, nor ascites ; no jugular dilatation. The pulse is rather small, but distinct, regular, 56 – 60 ; no evident præcordial prominence. The apex beats in the 6th intercostal space, and strongly raises the finger ; in the whole præcordial region, that is to say, from the base of the

heart to its apex, a well marked vibratory thrill is perceived; the corresponding dulness is $4\frac{1}{5}$ inches vertically, and $4\frac{3}{4}$ transversely. The valvular sounds are replaced by a double souffle; the second, more prolonged than the first, is accompanied by a kind of snoring sound; in ascending along the aorta, the double souffle is heard, but without this peculiar character. Besides, in the neighborhood of the heart, there is an amphoric sound, resembling that of water about to boil; at a distance from the præcordial region, the double souffle is no longer heard, and the amphoric sound disappears. The double souffle is heard, by propagation, at the lower part of the chest, on the left side. There is no vibratory thrill in the arteries; the respiration is everywhere good.

M. Bouillaud dictated the following diagnosis: *General hypertrophy of the heart* (12 to 16 ounces). *Thickening and induration of the left valves, with contraction of the auriculo-ventricular orifice.*

The next day, in the præcordial region, and even on the right side of the thorax, was heard a very distinct triple sound; it resulted from the decomposition of the second sound, and was accompanied by the souffles above mentioned; the amphoric sound was not distinguishable. The pulse was only 48 to 52; always tense and vibrating, but not redoubled. On the following days, the triple sound persisted, and became even more distinct; the last two sounds occupied the same space of time as the first, which was synchronous with the pulse; the last was always constituted by a souffle; in the course of the aorta, there existed only the ordinary double sound.

On the 23d of January, the triple sound was heard even in the carotid. Under the influence of digitalis, the pulse fell to 32. During the examination, the patient being agitated in his bed, a few moments after, M. Bouillaud observed four sounds, soon replaced by the habitual triple sound.

On the 31st, the triple sound persisted with the sharp

souffle which terminated it; it might be represented by tic - - - - tac - - - - ssss. M. Bouillaud explained the third sound by saying, that doubtless the left auricle emptied itself by a contrated orifice, when the ventricular diastole had been already finished. In the morning, the pulse had risen to 48. The patient was affected with an intense sore mouth, from frictions on the pubis with mercurial ointment.

On the 4th of February, the patient had just expired at the moment of the visit, without premonitory signs of such sudden death.

Before proceeding to the autopsy, let us return, for an instant, to some peculiarities in the history of the symptoms in this case.

Is it necessary to give the reasons for the diagnosis? In presence of this double souffle, so rude that it was accompanied by a vibratory thrill, evidently localized in the region of the heart itself; so strong that it was propagated even to the posterior part of the chest, and allowed nowhere the valvular flapping to be heard; who does not at once see, that either the two orifices are diseased, or the one which is alone affected is apparently so to an extreme degree? If it be considered that the souffle which is the roughest, which is mingled with a kind of scraping, ceases to offer this accompaniment along the course of the aorta, must it not be concluded that the bicuspid orifice is its point of departure? Finally, since it is at the second time that this sound is heard, must it not also be concluded that the lesion of this orifice is a contraction?

As to the amphoric murmur noticed the first day only, was it a phenomenon in relation to the lesions which we have just diagnosticated? Was it, for instance, of the same nature as the vibratory thrill? We think not. We would rather consider it a peculiar sound (of which we shall speak with more detail hereafter) which, although studied in other regions, has not, as far as we know, been signalized

in the præcordial ; we mean the rotatory sound [1] (bruit rotatoire). What confirms us in this opinion, is the description of it by M. Bouillaud without deciding upon its cause, its feeble propagation without the præcordial region, and, finally, its quick disappearance.

A word upon the triple sound, which we have noticed for the first time in this observation ; we shall speak hereafter of the different interpretations of which this curious modification in the rhythm of the heart's sounds is susceptible. Let us remark only the explanation of M. Bouillaud, which we shall soon see fully confirmed by the autopsy ; and also this peculiarity, that it seems necessary, for the production of this triple sound, that the succession of the heart's sounds should present a certain *slowness ;* since, imperceptible the first day, when the pulse was 56 – 60, it was heard on the next, the pulse having fallen to 48 ; and that, on the following days, it appeared to become more distinct in proportion to the increasing slowness of the pulse. Can we explain thus, why, in cases anatomically so analogous to the present, none has offered this triple sound, no one, if we are not mistaken, having presented a similar slowness of the pulse ?

Autopsy. — 25 *hours after death.* — The pericardium was uncovered in an extent of about $4\frac{3}{4}$ inches square. The heart, directed almost transversely to the left, was of triple the normal volume, depending partly on the distension of its cavities, the auricles especially, by sanguineous concretions ; in fact, on section of the vessels at the base, there flowed out an enormous quantity of half-coagulated blood, contained in the auricles, which reduced the volume of the heart one-third. The right auricle still contained a coagu-

[1] This is a confused, humming sound, heard in the præcordial region, resembling the sound of muscular contraction, to which it may, perhaps, be sometimes owing; it comes on, and disappears very suddenly. — See Part 2d. — *S. K.*

lum, as it were fatty, of an amber-yellow color, of the volume of an egg, and prolonged into the right ventricle, where it was of half the size ; (M. Bouillaud is confident that this coagulum was the cause of the patient's death). Freed from these concretions, the heart weighed, with the origin of the large vessels, 13 ounces.

Right side. — The valves of the pulmonary artery were thin, large, and well-formed ; the circumference of its orifice was about 4 inches. The cavity of the right ventricle was moderately dilated ; its walls were less than two-fifths of an inch thick. The right auricle was dilated ; it would have contained a large egg ; but its walls were of normal thickness throughout ; its columnæ well-developed, and hypertrophied. The orifice of the tricuspid valve was almost 6 inches ; the valve was well-formed, but enlarged, and slightly opaline.

Left side.—The aortic valves were sufficient, well-formed, but slightly hypertrophied, especially at the middle of their free edge, of an opaline and milky color ; the circumference of the orifice was $3\frac{3}{5}$ inches. The origin of the aorta was a little dilated, and studded with a few yellowish-white spots, without calcareous incrustations ; in certain points, there was a pale-red tint ; this coloration existed also, even more distinct, upon the aortic valves. No trace of cadaveric imbibition.

The ventricular cavity was hardly, if at all, dilated. The bicuspid orifice was transformed into an ovalar aperture (admitting the end of the little finger), the greater diameter of which was about 9 lines, and the smaller about 5 ; the two folds of the valve, adherent at their angles, circumscribed this orifice. They were thickened, fibro-cartilaginous ; at their posterior part, they were 5 lines thick, from the presence of a calcareous concretion, which, seen from the auricle, was separated into two valves, resembling a kind of shell-fish ; their edges were rough, unequal, and formed by calcareous

granulations. The columnæ carneæ, inserted to the valve, were strong, and their tendons hypertrophied; the summit of these columns was transformed into a tendinous substance. The endocardium, near the valve, was thickened, and changed into a fibrous tissue; it was unequal, and "shagreened." Separated by its circumference, the valve weighed 6 ounces. The auricle would have contained an egg of a goose; its walls were generally thickened (2 lines), from the hypertrophy of the fleshy tunic, which was of a vivid red; the endocardium was easily detached; of about double the normal thickness.

This autopsy is so exactly in relation with the symptoms and the diagnosis, that it does not furnish matter for many remarks. There is one point, only, which perhaps requires some notice; this dilatation, so considerable, of the right auricle, coinciding with the complete absence of notable infiltrations. Is this fact of a nature to invalidate our former remarks on this subject? We think not, for this reason: we had here, not only dilatation of this auricle, but hypertrophy, at least relative, of its muscular tissue; a tricuspid orifice of proportionate size, and closed by a well-formed valve; finally, the right ventricle not dilated, and the pulmonary orifice free; circumstanes little favorable to the stagnation of the venous blood, the point of departure of infiltrations. In our former observations, we have had passive dilatations; here we have, as it were, a veritable, active aneurism, probably the result of the inflammatory process, of which so many scattered traces were found, in the thickening of the endocardium, in the redness of the aorta, and in these amber-colored, fibrinous concretions, to the formation of which the inflammatory stomatitis of the patient may not have been stranger, aided, also, by the evident obstruction of the arterial circulation situated at the bicuspid orifice, proximate cause, if not the only one, of the dilatation of the left auricle, and which, by degrees, made its influence felt

even to the right side of the heart, whose obstruction, as we have seen, seems to have caused the asphyxia of the patient.

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Here terminates the first part of this memoir, the *clinical observations.* It would be easy to add other facts, not less convincing; but we should fatigue the reader, and fall into superfluous repetitions. We think we have exposed all the principal alterations of the heart, or at least the most common; and have also sufficiently shown, by post-mortem examination, the possibility of a precise and positive diagnosis in all these cases. We have seen, in almost all, a perfect concordance between the autopsy and the diagnosis; and when there has been any error, or omission, it has always been clearly pointed out, which has not been without profit, as an error in medical science, once signalized, is the best means of preventing a similar error in future.

Let us now return to these observations, to expose and study, in their turn, the different means of exploration, by the assistance of which, diseases, once thought inscrutable, have been submitted to such minute analysis; but before commencing this second part, let us glance at the different lesions which we have described, and see if, by this general comparison, we cannot deduce some conclusions not as yet mentioned.

And first, it should be remarked, what a striking difference there is in the frequency, and more particularly in the gravity of affections of the pericardium, and those of the heart itself. In our twenty cases, we have not had a single example of decidedly acute pericarditis, or of those considerable effusions into the pericardium, which may of themselves terminate fatally. We have followed, during six years, the visits of M. Bouillaud, and we have only observed this com-

plication five or six times. We have not cited these cases, as our object was here to study affections of the heart itself, rather than those of the pericardium, whose symptoms and history are well known; and because these observations would have added nothing essential, under the point of view which should interest us here.

If the grave lesions of the pericardium are rare, it is not so with the latent lesions, which have been revealed at the autopsy by some slight circumscribed adhesions, and slightly projecting, isolated patches. These are, if we may say so, the almost necessary accompaniment of grave lesions of the heart, and which, in our autopsies, have been rarely wanting; although we have generally passed them over in silence, except where these adherences, or false membranes, have been of a nature either to become of themselves the cause of functional disturbances, or to lead to the suspicion of their existence by perceptible signs, *as in observations* 9, 13, 14, *and* 18.

As to the heart itself, the first thing which strikes us, is the singular predominance of the lesions of the *left* side of the heart over the *right*. We have often seen, it is true, the right side participate in the hypertrophy of the left, to a certain degree; but has there not always existed such a marked difference between these two kinds of hypertrophy, that it was easy to see that the hypertrophy of the *left* cavities must have been a *capital*, *primitive lesion*, and that of the *right*, on the contrary, *accessory and secondary*? As to the valvular lesions, have we not almost always found them in the *left* cavities, those of the *right* side having consisted, for the most part, only in a *passive* enlargement of the orifices, of the *tricuspid* in particular?

Upon what depends such a marked difference between two cavities, so near together, and so analogous in structure? It can only depend on the *difference in the blood, which traverses each*. *Anatomically*, side by side, the right and left cavities are

very distant from each other in a *physiological* point of view ; they are here separated, in fact, by the *whole distance existing between the arterial and the venous blood.* As regards the pathogeny of these affections, we unhesitatingly adopt the opinion of M. Bouillaud ; *inflammation of the internal membrane of the heart, sanguineous congestions of the different parts of the organ, and, we may add, the molecular composition of their blood, seeming to us the essential points of departure in the alterations of structure, presented either by its muscular tissue, or its valves.*

Still, there is another condition, which should be taken into account in the anatomo-pathological study of the heart; this condition, secondary, it is true, and supposing always the existence of a previous morbid condition, is the effort of the blood, internally, upon the walls even of the cavities; an effort of dilatation, purely mechanical, whence results the enlargement of these cavities and their orifices, and which, be it understood, does not exclude, in the explanation of eccentric hypertrophy, the agency of increased nutrition, submitted, perhaps accidentally, in the morbid increase of the organ, to the same laws as in the normal growth, that is to say, having at the same time increased the volume and capacity. Besides, this mechanical dilatation is met with especially in the partial enlargements, presented by a particular cavity or orifice, beyond which the current of blood is more or less intercepted in its free passage.

We have said that the right side of the heart more particularly offered these *passive* alterations, if we can call them so ; a few remarks now, on the mechanism of their formation. If it was usual to find organic lesions of the pulmonary valves, and contraction of the corresponding orifice, it would be easily conceived that, from this obstacle, the right ventricle, and even auricle, would be dilated ; but, as can be seen from our observations, this lesion of the pulmonary valves is not at all common. Yet we have often met with dilatation of the

right cavities; why is this? Because, according to M. Bouillaud, *an obstacle, situated in the left cavities, exercises, by degrees, upon the circulation of the right, an influence, which is none the less real for being more distant. Let us explain this by an example.*

A lesion exists at the aortic orifice; this lesion arrests, or at least obstructs in its progress, the blood sent from the left ventricle; a part of this blood remains, then, in the ventricle, and hinders the auricle from pouring its normal quantity into it. The auricle containing this quantity of blood in reserve, the pulmonary veins, which open into it, are incompletely emptied; the same will be the case with those of the pulmonary parenchyma which supplies them. If this parenchyma remains thus filled with a quantity of blood which it ought be freed from, it cannot receive all the venous blood brought by the ramifications of the pulmonary artery; and then, retrograding in its turn, the current of venous blood distends in succession the pulmonary artery, the right ventricle, the right auricle, and, finally, the whole venous system, giving rise to partial or general serous infiltrations.

It was by taking into consideration the extent and importance of these serous infiltrations, that we often diagnosticated dilatations of the right cavities, and especially of the auricle, afterwards verified by the autopsy. It should be added, that if, at the commencement of these obstructions to the venous circulation, the right ventricle should redouble its efforts, and, by this excess of muscular contraction, cause palpitations and dyspnœa; if it should then contribute to the hypertrophy of its tissue, a time may yet arrive when its dilatation will be such, that, having lost in contractile force what it has gained in capacity, the very feebleness of its contractions will be a new cause of stagnation of the blood; assisted also by a morbid condition not yet mentioned, and which results from the very fact of the dilatation of the right cavities; we mean the insufficiency of the tricuspid valve, which we

have often noticed after death, and even indicated during life.

To sum up what concerns the right side of the heart, from our observations: *most frequently*, we do not pretend to say *constantly*, there has been *eccentric hypertrophy*, *and passive dilatation;* often, *simple hypertrophy*, that is to say, *without notable valvular lesions*; to this may be reduced its anatomo-pathological history.

In the left cavities, on the contrary, *hypertrophy without valvular lesion is almost an anomaly;* we have cited an example in the first observation, but, even here, the valves were not *perfectly healthy.* As in the right cavities, the *auricular* orifice is almost always the seat of the lesion; or, it here predominates, even when there is coexisting *aortic* lesion. We have, more than once, suggested the probable reason of this predominance, in the influence which the tendinous chords, inserted into the bicuspid valve, may exert upon the coagulation and deposit of the fibrin of the blood.[1] As on the right side, we have often here partial dilatations of the ventricle or auricle; but we have less frequently found, in the left cavities, the orifices free, or dilated. The narrowness of these orifices is even one of the lesions the most commonly observed, whether insufficiency has coexisted, or not. Apropos of this, we may mention this peculiarity, perhaps curious to believers in final causes, that, by the very disposition of the morbid lesions presented by the two sides of the heart, it seems as if nature had foreseen the inevitably fatal termination in these affections, sooner or later, and had wished to defer it to the latest moment. *We will explain this point.*

Of all the mortal dangers which may result from hypertrophy of the heart and valvular lesions, these are the *two principal: the afflux of a too great quantity of blood to the*

[1] See observation 12.

brain, *whence apoplexy;* and the arrival of too *small a quantity to the lungs*, *whence asphyxia.* We say that, as they are usually met with, the lesions of the orifices seem to be as favorable as possible to prevent both of these accidents. For instance, the *right* orifices, which supply the *lungs*, are, as we have seen, always *freely open;* the *left* orifices, which supply the brain, are most commonly *contracted*, or *insufficient*, so that here results, *either an imperfect issue of the column of blood*, *at the first time*, *by the contracted aortic orifice; or a division of the column*, *by its reflux into the auricle at the first time*, *or the ventricle at the second*, *from insufficiency of the auriculo-ventricular and aortic orifices.*

We repeat, this peculiarity is, in our opinion, rather a curious accident, than a precaution of nature, or a trace of order in the middle of disorder; we merely mention it, in passing, as it may merit some attention, in the *prognosis*, in the general study of the diseases of the heart.

We shall commence, in the Second Part, the examination of our *means of exploration;* not to make here a complete treatise upon diagnosis, but to bring forward the practical views, suggested by the clinical observations which we have here analyzed.

END OF PART FIRST.

PART II.

A BRIEF STUDY OF THE MEANS OF DIAGNOSIS IN DISEASES OF THE HEART.

At the head of the list of symptoms is the state of the *pulse;* this is naturally the first object which strikes the attention. There are two things, as every one knows, to study in the pulse: quantity and quality. The quantity is commonly essential to be noticed only in the acute affections, as pericarditis, endocarditis, &c.; the pulse in these cases may be of extreme frequency; it has sometimes exceeded 130 and 140. Our twenty patients have not offered cases of this kind; we shall mention only the cas of sanguineous concretions (observation 19th), where the heart beat 124 times in a minute, as if to make up, by the multiplicity of its contractions, for the insufficiency of each one separately. In these generally, then, there has been nothing remarkable as regards the quantity of the pulse; but the contrary is the case as regards the quality.

The qualities of the pulse, important to appreciate in acute affections, are especially so in chronic diseases of the heart; here, be it remembered, that more than once the pulse has been to us the first index of an affection of this organ, and given rise to a supposition which a more detailed examination has rendered certain. At one time, the pulse, vibrating, resisting, developed, has at once announced (as in the 5th observation) a

hypertrophy of the heart, particularly of the left ventricle; and from the development, we have been led to conclude that there was neither notable narrowness of the orifices, nor considerable valvular insufficiency, unless a great hypertrophy of the arterial system; at others, the opposite characters have led to the diagnosis of opposite lesions. We have almost always been able to perceive a perfect agreement between the condition of the pulse and that of the heart; the first seeming, as it were, the echo of the second. Sometimes, however, we have noticed a discordance between these two conditions, which has become in itself a new sign, announcing, for instance, the presence of some obstacle between the ventricular contraction and the radial pulsation (Obs. 19).

But the qualities of the pulse have not been changed in all our observations; and it is well to know this practical truth, that if certain disorders of the pulse often correspond to certain lesions of the heart, the absence of the first does not necessarily suppose the absence of the second. In many of our patients, the pulse has remained regular to the last. This leads us to the reflection, that if the ancients, deprived as they were of the positive physical signs which other methods of examination have furnished us, considered the pulse as the principal guide in the study of these affections; that if Corvisart himself has thought it proper to develope, with such care and detail, all the indications of the pulse; it must be allowed that the progress of science has not completely sanctioned their confidence and praise. For instance, who would now dare to diagnosticate a lesion of the heart, simply because the pulse was irregular, intermittent, or unequal? characters extremely deceitful, as they may coincide with lesions purely dynamic, or nervous.

It has been pretended, nevertheless, that these signs are capable of indicating a lesion of such an orifice, or valve; and that, thus, the irregular, unequal, small, intermittent

pulse announces rather an aortic, than a bicuspid contraction. A glance at our cases will show that this law, true in certain cases, is not without exception.

Among our 21 patients, the pulse has been noticed, more or less unequal or intermittent, in the 7 following cases only : —

Obs. 1. Hypertrophy without very notable valvular lesions; pulse moderately developed, unequal, intermittent, irregular.

Obs. 6. Medium hypertrophy ; thickening of the valves ; cretaceous state of the aorta. Pulse intermittent, little developed, but hard and vibrating.

Obs. 11. Considerable hypertrophy ; deformation of the valves; bicuspid insufficiency. Pulse equal, but intermittent, and not proportioned to the strength of the subject.

Obs. 13. Double contraction, with bicuspid, and perhaps aortic insufficiency; adhesions in the pericardium. Pulse slightly unequal, little developed.

Obs. 15. Bicuspid and tricuspid contraction; bicuspid insufficiency ; slight aortic thickening. Pulse regular, but a little unequal ; moderately developed ; not vibrating.

Obs. 19. Dilatation of the right cavities ; aortic vegetations ; bicuspid narrowness; coagula in the heart. Pulse small, unequal, intermittent, irregular.

Obs. 20. Bicuspid narrowness and slight insufficiency ; slight aortic thickening ; coagula in the heart. Pulse rapid, very small, and unequal.

We see, consequently, the intermittence or inequality of the pulse coexisting with the most different lesions; from simple hypertrophy to the most complex valvular alterations, and sanguineous concretions in the interior of the heart. If it be asked, if, in the 14 other cases, there was not a necessary relation between the organic lesions and the characters of the pulse ; it may be answered, that in these the pulse was noted as preserving its regularity. We will mention

particularly, the bicuspid insufficiency (obs. 2); the thickening of the aortic valves, without insufficiency (obs. 3); the same lesion, with insufficiency (obs. 4); the narrowness of the two orifices, with vegetations of the bicuspid valve, and cretaceous state of the aortic (obs. 16).

It must be admitted, then, that the pulse is a useful, and even precious aid in the study of diseases of the heart; but let us not, for this reason, by exaggerating its importance, demand of it the light which it cannot give, and place in it that degree of confidence justly merited only by more precise methods.

We must make an exception, however, in favor of a quality of the pulse, of which we have as yet said nothing; we mean the *vibratory thrill*, sometimes presented by the current of blood, most frequently in the arteries in the neighborhood of the heart. This quality of the pulse coincides often with the general causes of the vibratory thrill; or, more particularly, with a contraction of the aortic orifice (see observations 5, 12, and 18).

To continue, — we have noticed the pulse of our patient; now let us uncover his chest, and examine the præcordial region; for there are several signs furnished by the *sight alone;* these are the *præcordial prominence, the displacement of the point of the heart, and the beatings of this organ.*

The *first is not always a morbid phenomena;* in certain individuals, the left mammary region is more developed, and more prominent than the right; this may be natural, or produced by the more frequent muscular exercise of this side, as in left-handed persons. Præcordial prominence may also depend on a deviation of the vertebral column; it may be easily conceived, that when this is convex forwards and to the left, the ribs, under the influence of this deviation, may form a projection in the præcordial region.

Although this may be, in some cases, without value as a

symptom, it is not always so. Almost constant in any considerable hypertrophy of the heart, and in hydropericardium, the prominence, more or less circumscribed, of the præcordial region is a pathological phenomena, incontestable, and susceptible, though rarely, of presenting, in the course of certain acute diseases of the heart, perceptible increase and diminution in a short space of time; the same may be said of the dulness. This prominence, often easily seized at the first sight, is not always so evident; in order to be sure of its existence in doubtful cases, and to measure the degree, we have caused M. Charriere to make a small, very simple instrument, which we have called a cyrtometer (from κυρτος, curve, and μετρον, measure.)[1] This instrument can only show a præcordial prominence after it has been first applied to the right mammary region, and by applying it in various directions, always employing the same pressure in the comparison; with these precautions, the instrument has seemed to us to answer the purpose completely. Besides, the præcordial region, which suggested the idea, is not the only one to which it may be applied; whenever it may be interesting to measure any limited morbid swelling, the cyrtometer may be used with advantage.

Displacement of the point of the heart. — Some have said that the heart should beat, in the normal state, at about an inch and a half below the nipple. This is not always true, as the nipple is susceptible of natural and considerable transpositions, especially in a vertical direction. We have seen the apex at nearly double the distance indicated below the nipple, the heart being perfectly healthy. If the nipple be taken as a limit, let it be rather the lateral one; and we may,

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[1] It is a blade of steel, furnished in its middle part with a graduated scale, upon which moves a slide, which two rods, parallel to the steel blade and fixed at each end, cause to move, when any curvature is given to the steel blade. — *S. K.*

then, say that the apex beats between the nipple and the sternum, but nearer to the former, adding, as almost constant, in the 5th intercostal space. This determination is so exact, that during many years' observations, we have not yet met with a single exception; and that we have often been led to suspect, and with justice, the existence of an organic affection of the heart, from the single circumstance that the apex was perceived either to the outside of, or below the place here indicated.

In the organic diseases of the heart, it is displaced either in both directions, or in only one; in other cases, the morbid lesion is situated elsewhere. Thus, we have seen a pleuritic effusion of the left side push the heart even into the right mammary region; we have seen abdominal tympanites, or ascites, raise it even into the second intercostal space, notwithstanding the existence of a considerable hypertrophy, (as our 10th observation has furnished an example.)

The movements of the point of the heart are not always visible, and frequently a strong pressure of the finger is necessary for their perception. This is none the less true of the third sign, seen on inspection of the præcordial region, *the beatings of the heart itself.*

In a thin person, in whom from any cause the contractions of the heart are accelerated, the præcordial region is seen raised not only by the *point*, but feebly by the *base* of the organ. This may be more or less sudden and distinct; but, except in disease, it is generally limited to an extent of 3 inches square, at the utmost. In the organic affections, on the contrary, these beatings may be much more extensive; even doubly; they may be propagated, by the diaphragm, even into the substernal hollow, at the same time that their impulse raises suddenly and visibly the stethoscope, or the head of the observer. The extent of these beatings is the important point; their force is but a secondary phenomenon; this impulse being compatible with a physiological condition,

unless it surpasses certain limits, which habit teaches us to determine. It is well known, that after running, the heart beats "strong," as the expression is ; but it does not for this beat in a proportionably increased extent of the præcordial region. These extensive beatings constitute, then, a morbid phenomenon, and, we may say, essentially characterize hypertrophy of the heart; the same may be said of the preceding signs. But the existence of extensive beatings is not so necessary in hypertrophy, that their absence immediately excludes the affection which their presence characterizes ; this sign may be wanting, more or less completely, from the embonpoint of the patient; the coincidence of another affection, as pleural, or pericardiac effusion ; from the feeble degree of the hypertrophy ; or the weakness of the ventricular contractions, from the progress of the disease, or the treatment employed.

May we also say, that, if hypertrophy of the heart is characterized by the extent and vigor of the beatings, the absence or the weakness of these may have for cause an opposite condition, atrophy ; a condition not often met with, and which our observations have not presented ; this state of the heart, unlike hypertrophy, almost always existing alone, and even perhaps necessarily, supposing the absence of valvular lesion ?

Finally, when it is by application of the hand that the beatings are perceived, a peculiar circumstance may present itself ; a certain sensation of *obstruction or embarrassment in the ventricular contractions* difficult to describe, and requiring a certain habit for its perception ; but which indicates, to an experienced hand, the existence of *bridles or pericardiac adhesions*, which confine the movements of the heart. — (See our 13th observation.)

If the abnormal extent of the beatings of the heart, in cases best calculated to produce this result, sometimes may be imperceptible to the eye or hand, there is another means of

exploration, which will usually reveal the hypertrophy : *percussion.*

The normal dulness, corresponding to the heart, is from $1\frac{1}{2}$ to $2\frac{1}{4}$ inches square, *when the dulness exists at all;* we make this reserve, because very often the most skilful percussion cannot detect a dull sound in the præcordial region, either that the stomach, distended by gas, masks, by its clear sound, the dulness sought; or that (which is the most common) a portion of lung is placed before the heart, thick enough to produce the same effect. In disease, however, and more particularly in any considerable *hypertrophy*, percussion not only *detects,* but even *measures* (and this often with mathematical precision) *the increase of the organ.* There are very few of our clinical facts, where this mode of exploration has failed; and we have seen, in two cases especially, (observations 7 and 21,) how exactly its indications have agreed with the autopsy. It is this abnormal dulness, which has served us as basis in estimating the heart's weight, a secondary matter in the diagnosis, but still frequently confirmed after death. As to the limits of this dulness, it has varied, in our observations, from the normal amount, to more than 6 inches in one direction (obs. 19); generally, it is in the *transverse* direction, that the dulness has been most extensive.

In what has preceded, we have seen only signs of *hypertrophy;* let us now proceed to lesions deeper seated. And first, supposing the hand still applied to the præcordial region, a new sign may be presented to our observation: *the vibratory thrill.*

This sign, first signalized by Corvisart, supposes necessarily, or at least generally, as do most of the morbid sounds of which we shall soon speak, *two conditions:* 1*st, a certain degree of quickness and volume in the current of blood, and, consequently, a certain force in the ventricular contraction;* 2*d, a greater or less obstacle, which obstructs its passage,*

and increases the friction of the molecules. We will say, in anticipation, that these two conditions will be found in all our souffles; so that, if every *souffle does not necessarily suppose a vibratory thrill, every vibratory thrill necessarily supposes a souffle.*

This thrill is not a rare phenomenon; in our 21 cases, we have met with it 6 times. (Observations 12, 13, 16, 18, 19, and 21.) If we now ask with what *lesions it coexists*, we shall see, that, in our observations, they were always either *fleshy vegetations, or cretaceous or calcareous concretions, at one orifice only, but most frequently at both.* According to M. Bouillaud, there are cases not easily explained, of vibratory thrill, without organic lesions of the heart.

If, in this respect, this sign may sometimes deceive us, it is not so with the following, which belong to the domain of auscultation.

Sounds of the heart. — The details into which we have entered, on the occasion of each observation, and the abstract considerations which have preceded them, may perhaps render superfluous this part of our remarks. Still, we think that to unite in one table the practical reflections there scattered, will be a useful, if not a necessary, complement of our diagnostic studies, whose clinical interest will excuse a little repetition.

We shall divide into six principal categories the sounds perceptible to the ear applied to the heart. These sounds may be *normal, increased, diminished, modified, replaced, or accompanied;* let us briefly examine these divisions.

1*st Division. — Normal sounds of the heart.*

We shall not repeat here what was said, in the commencement of the work, on the four causes which seem to concur in the production of these sounds; on the predominance of the valvular flapping, which these clinical studies have so fully demonstrated; or the anatomical reason, why the first

sound is a little the dullest and longest, and the second shorter and more clear; &c. &c. We will only call to mind that the maximum intensity of the first sound is below, and a little to the outside of the breast; and of the second, above and to the inner side; and that this difference is often more easy to perceive in the morbid, than in the normal state. We would also engage the reader, who wishes to pay attention to the diagnosis of these affections, to auscult, with the greatest care, the normal heart, before attempting the diseased conditions; for it is almost incredible, of how many various shades, impossible to describe, the normal state is susceptible; and how much the knowledge of these different shades facilitates the study of the abnormal sounds.

Before quitting the normal state, a word upon a stethoscopic peculiarity, which we have seen no where mentioned, and of which it is well not to be ignorant. It has happened to us, three times in two years, to hear, at the moment when the ear was applied to the præcordial region, a *confused humming sound, intense enough to mask every other; after persisting so long that we thought it proper to notice it in our notes of the observation, it disappeared suddenly, and without return.* This seemed to us to be a sound (bruit rotatoire) resulting from *contractions of some of the fibres of the pectoral muscles;* the third time that we met with it, (in a patient with a gastro-intestinal affection, without fever,) after having tried in vain the interposition of the stethoscope, the suspension of the respiration, &c., we made the patient sit down, with his arm resting at ease on his bed, when the sound almost instantly ceased, without returning, allowing the perfectly normal sounds of the heart to be perceived. Of the two other cases, one was a cerebral hæmorrhage, in a way of absorption; the other a coexistence of hæmorrhage and softening of the left hemisphere, with partial meningitis. In regard to the last patient, we asked ourselves, if the rigidity and contraction of the left upper extremity was not a reason

for supposing a similar and profound contraction of the præcordial muscles; but the invalidity of this hypothesis was manifest, when we saw the rigidity of the arm persisting and the rotatory sound disappearing; at the autopsy, nothing remarkable was noticed in the heart.

Besides these three, we have noted another example of this sound in the 21st observation; but we mention this with some doubt, as we merely noted the observation, which dated long before we entered the hospital.

But enough upon a merely accessory phenomenon; we will now pass to the *morbid* sounds, properly so called.

2d Division. — Increased sounds.

The sounds of the heart may exceed the normal state, if the expression be allowed, either as regards their clearness, or their fulness and force; they may be, in a word, clearer and stronger than normally.

The increased clearness of the sounds is not always of a positive clinical value; it may depend on the emaciation of the thorax, or the neighborhood of the stomach distended by gas, as is frequently observed in chlorotic girls. Sometimes, however, it depends on the dilatation of the heart's cavities, especially when this coincides with thinness of their walls, (the passive aneurysm of Corvisart); a lesion rarely coexisting with the complete absence of valvular deformation which these sounds suppose. Most frequently, in an organic affection of the heart, one sound only presents this clearness; for the most part, the second; this being normally the clearest of the two, if the first be ever so little obscured, by this very fact, the contrast becomes sufficient to strike the ear.

The stronger, more distinct, sounds are also compatible with a physiological state, or, at least, with the absence of all organic lesion. After a rapid run, and in purely nervous palpitations, the heart often beats with such force, that the sounds necessarily participate in the vigor of the impulse.

If this be true where the ventricular contractions are only momentarily increased, there is still greater reason for it, when the increase is permanent and organic, as in hypertrophy. Still, we can rarely, in hypertrophy, notice these clearer sounds; for, if the valves participate, ever so little, in the hypertrophy of the muscular tissue, a new shade is immediately perceived; the sounds become dry, parchment-like; see the first observation, where these sounds were noticed, and where the thickening of the valves was so slight, that we considered it a type of almost simple hypertrophy.

3d Division. — Diminished sounds.

In this, diametrically opposed to the preceding, we shall make two subdivisions; the sounds may be either simply enfeebled, or completely wanting. In the second case, two conditions are possible: either the heart has ceased to beat, when there is complete syncope; or it beats too far from the ear, and separated from it by a liquid, which feebly conducts the sound; and, in considerable hydropericardium, the absence of the heart's sounds is not less characteristic than the præcordial swelling, increased dulness, &c.

If the sounds be simply diminished, that is to say, less clear, or less strong than normally; if they are, as some have named them, dull, stifled, veiled, distant; different conditions, morbid, and even natural, are possible: for instance, to commence by the latter, the patient's embonpoint, the interposition of a portion of lung, a state of semi-syncope, are so many circumstances, which weaken the sounds of the heart. Neither is this observation puerile and without practical value; for we have seen many cases, where an exercised ear might hesitate, to account for the weakness of the sounds, between one of these just-mentioned circumstances, and one of the lesions we shall now enumerate.

These lesions are various; and many are, of course, indicated, in a measure, by the opposite lesions of the preceding

division. Thus, if dilatation of the cavities, with thinness of the walls, may increase the clearness of the sounds, it is evident that the opposite character should be the result of opposite anatomical conditions; if simple hypertrophy may be indicated by strongly-marked sounds, atrophy will be characterized by feeble ones.

To speak now, for the first time in this part, of the valvular play, so important in the stethoscopic history of the heart; a commencing endocarditis has sometimes the effect to render the valvular sounds hoarse, if we may use the expression; as if there existed a symptomatic analogy between the slight tumefaction of these membranous valves and that of the vocal chords, in the first stage of laryngitis.

It has been shown, in the course of this clinical analysis, how the blood, whipped, as it were, by the chordæ tendineæ, often deposits its fibrin in the interior of the heart, and especially upon these tendons, or the valves to which they are attached. This coagulation, molecular in its commencement, the first rudiment of fibrinous concretions, which may become so large as to completely obstruct the heart's action, has also for result to lessen the vibration of the valves, and deaden their flapping sound.

Finally, before a hydropericardium becomes so great as to stifle completely the sounds of the heart, it naturally gradually weakens them, or allows them to be heard but at a distance; which is the prelude, more or less rapid, of their abolition.

4th Division. — Modified sounds.

This modification may affect either the seat of the sounds, their tone, their rhythm, or their number.

1st. *Sounds modified in their seat.*—This subdivision corresponds to the displacement of the heart, congenital or acquired. It is well known, that in congenital displacement of the heart, the other thoracic and abdominal organs present the

same transposition; the acquired displacements almost exclusively result from a pleuritic effusion. We have seen a patient, in whom the heart beat directly under the right breast, from this latter cause; in another, the heart was situated in the inferior hollow of the sternum; in these cases, it must not be supposed that the diagnosis is at once indicated by the complete absence of the sounds in the præcordial region; these sounds are often very distinct from propagation, which we have seen deceive the ear for a time, until a more careful examination, by auscultation, inspection, and application of the hand, has determined the exact point of departure of the abnormal sounds. This subdivision need not detain us longer.

2d. *Sounds modified in their tone.* — It may be thought that this is a mere repetition of what has been said on the increased or diminished clearness of the sounds, if our meaning be not at once explained. When we say that the sounds may be modified in their tone, we do not mean an impression of excess or diminution of any of the qualities perceptible to the ear; we mean a new quality, a distinct shade of sound, which M. Bouillaud has designated under the name of *dry, or parchment-like;* not that, as is sometimes thought, there is a resemblance to the sound of parchment, or of new leather, which we shall see hereafter; but because, to an ear accustomed to auscultation, the sounds then present a character of dryness and hardness, similar to what would be produced by the flapping of parchment valves.

The reader, little practised in auscultation, may think this a mere pretence, and a sound too delicate to be distinguished; but we can assure him, that after long exercise in becoming familiar with this shade, it will be one of the most incontestable of the morbid sounds, and the expression, parchment-sound, will convey as exact an idea as any of the stethoscopic signs.

Nay, more: this sound is, we think, one of the strongest proofs of the theory of M. Roannet. The *lesion, with which it corresponds, constant and unique, is thickening of the valves, without deformation;* not the slight swelling, the result of commencing endocarditis, which we have seen producing the "hoarseness" of the valvular sounds, but doubtless a little more induration of these membranous folds, a slight increase of their nutrition; in a word, not the *congestion* of the valves, but rather their *hypertrophy.* See our observations 1, 7, 10, &c.

3d. *Sounds modified in their rhythm.*—We have seen that the pulse is susceptible of inequalty, irregularity, and intermittence, which have their point of departure and their cause in a corresponding irregularity in the contractions of the heart; we should naturally expect to find here the same disorder in the valvular sounds. Indeed, these sounds may present, in their succession and their rhythm, as many analogous disorders; they may even present more, for an obvious reason. For the radial pulsation, as it were a distant echo of the ventricular systole, to be felt by the finger, there is necessary both a certain volume in the column of blood, and a certain force of impulse on the part of the heart; but these two conditions are necessary, to a less degree, for the nearest result of the heart's systole, or even the arterial diastole, to arrive at the ear; that is to say, the flapping of the valves; the ear, then, can perceive more valvular sounds, normal or abnormal, than the finger can count radial pulsations. This happens, for instance, in what M. Bouillaud has called the "faux pas" of the heart, or when the ventricle, incompletely filled, on account of an auriculo-ventricular contraction, beats almost empty; it also takes place in the false intermittence of the beatings; that is to say, when, instead of being completely stopped, as in the true intermittence, the ventricular systole is only more feeble; it may take place, too, in those disordered and irregular movements

of the heart, when its beatings, unequal in themselves, and repeated at unequal intervals, present to the ear only a confusion, tumult, and, if we may use the expression, a chaos, the more inextricable often because the two times are mixed together in it, and thus for a single systole there are two or three diastoles ; or, at another moment, two or three systoles for one diastole.

Such evident disorders as these correspond, we may say, of necessity, with one or many organic lesions of the heart. We have shown, when speaking of the pulse, that they furnish no positive indication of the kind, or special seat, of these lesions ; nay, more,—these disorders may coexist with a complete absence of these lesions, with palpitations merely nervous. We have often detected these palpitations, by the want of rhythm here spoken of, before the patients had mentioned their existence ; in these cases, we generally observe intermittence ; sometimes also other irregularities, but which seem still subject to a certain order of periodicity, returning, for instance, in the habitual state of calmness, after an almost uniform number of regular contractions. But this is only a secondary consideration in the differential diagnosis of these nervous irregularities from those depending on an organic lesion ; these last are always accompanied by a train of other symptoms ; such as the impulse of the heart's point, though irregular, vigorous, and heavy ; souffles, and other morbid sounds ; symptoms, whose absence characterizes merely nervous palpitations.

4th. *Sounds modified in their number.*—Sometimes, on auscultating the heart, instead of two only, three sounds, or four even, are heard. This peculiarity is rather curious, than important in a clinical point of view ; it is not rare, as regards the triple sound, as in the wards of M. Bouillaud we have seen three or four cases at a time. In almost all the cases observed by us, it was at the second time that this abnormal duplicity existed ; and the last two sounds were so short and

near together, compared to the first, that it brought to mind the dactyle of Latin verse, or a long and two short sounds; this triple, or dactyloid sound has been compared by M. Bouillaud to the "rappel" of the drum, or the triple sound of a hammer rebounding upon an anvil.

This modification of the sounds has always been found to coincide with organic lesions of the heart; but with what lesions, in particular? This has not yet been positively determined; M. Bouillaud, in his treatise on the diseases of the heart, says, that he has met with the triple and quadruple sounds only in patients having a contraction of some of the heart's orifices, with induration of the valves, accompanied commonly by the consequences of a pericarditis. We have been often disposed, at the bedside, to refer the triple sound to a contraction of the bicuspid orifice, with hypertrophy of the left auricle; supposing that the auricle doubtless contracted twice upon the column of blood intercepted by the narrowness of the orifice, whence resulted the third sound, which ought to be (as in fact it is commonly in the triple sound) a somewhat short souffle. In our observations, there is but one case of triple sound, followed by an autopsy (obs. 21); here we have seen narrowness of the bicuspid orifice, and hypertrophy of the left auricle; we have also seen this same hypertrophy existing, to a great degree, in the heart of a horse, in which was a very distinct triple sound. These are facts, then, in support of this explanation; but, on the contrary, how many times have we seen this hypertrophy of the left auricle, with contraction of the bicuspid orifice, without this supernumerary sound? Is it said, that the quickness of the circulation was the sole cause of this absence? For our part, although we allow that there are cases where the triple sound is really produced by the cause above indicated, the fourth sound also seeming to be sometimes the result of a pericardiac friction added to the sound of the first time, we rather think (and M. Bouillaud some-

what inclines to this opinion) that these derangements in the rhythm of the heart's sounds are the effect of a corresponding derangement in the synchronism of its normal sounds, or in their relative duration; a derangement which may depend on a lesion of any of the orifices. Let us suppose, for example, that the flapping at the second time, normal or not, of the aortic or pulmonary valves having ceased, a slight souffle still persists, produced by the slower passage of the blood obstructed by the narrowness of an orifice; this orifice may be, evidently, either the contracted bicuspid, or the insufficient aortic. Let us now suppose (and we have seen examples of it, though more rarely) that the triple sound is caused by the doubling at the first time; evidently, this duplicity of the first sound may result either from the insufficiency of the bicuspid orifice, against which a portion of blood still strikes, when the more or less normal flapping of its valve (which is not incompatible with its insufficiency), or the tricuspid flapping, has ceased; more frequently, it will result from the narrowness of the aortic orifice, whose souffle, it is easy to conceive, would be more prolonged than the bicuspid or tricuspid flapping; or because, the left ventricle contracting twice on the column of blood incompletely expelled, the bicuspid valve flaps twice in immediate succession.

In order that this duplicity of one time may be perceptible to the ear, it is, of course, necessary that a certain interval should exist between this time and the return of the other; there must not be too great quickness in the succession of the sounds, lest the single sound return before the double one has been perceived; this has been verified by observation.

It is not, then, difficult to account for these multiplied sounds, and to show that they contradict in nothing our valvular theory — nay more; on considering the duplicity of the possible, if not the actual, condition of the sounds, (nor-

mally existing for the production of each sound of the heart) that is, the escape of the blood by one orifice and its arrival at the same time by another, it would seem astonishing that the triple or quadruple sound does not exist oftener, were it not for the necessary conditions of silence between the two sounds, mentioned above.

M. Bouillaud has remarked, on the other hand, that there is often a single sound of the heart, if not real, at least apparent, depending on the following circumstances: existence at one time of a prolonged souffle, and shortness of the interval separating the two times. In these cases, the souffle in a measure absorbs the other sound, and does not permit it to be heard; either because it still exists, or has been repeated, when the other sound is produced. We have mentioned several examples of this, in our observations; we have often noted that thus the existence of a double souffle might be wrongly supposed; and that it is a good precaution, before deciding upon this question, to remove the ear beyond the præcordial region, in order to see if a moment does not arrive when the souffle, weakened by distance, allows the flapping of the other sound to be distinguished. We may arrive at the same result, though less promptly, by rendering the movements of the heart slower, as by digitalis; in this manner, the duration of the silence between the two sounds is increased, and thus they are rendered distinct from each other.

It seems, however, that cases exist, where the second sound really is wanting, the movements of the heart being of extreme feebleness. We have not observed such cases; but they are mentioned by M. Bouillaud, who adds, that the absence of the second sound supposes only the weakness, not the complete cessation, of the corresponding movement of the heart; without which movement, we cannot conceive the circulation to be carried on.

5th Division. — Replaced sounds.

In all the morbid sounds which we have hitherto noticed, it is possible to find and recognize, more or less distinctly, the primitive character of the normal sounds of the heart, the valvular flapping; in a word, all these sounds may be considered, more or less, as altered flappings; in those which will be treated of in this division, there is no longer a flapping; or, if it exist, it is only an accompaniment, an accessary, often natural, of a totally different sound, both in its sonorous qualities, and in its cause.

The flapping sound, as we have said, is the result of the closure and vibration of the valves of the heart; this new sound arises, most frequently, because these valves can neither close nor vibrate properly. In the flapping, there was the shock of the blood against a valve; in the present sound, there is the friction of the blood against it. The flapping indicates that an orifice is closed; this sound will generally indicate that an orifice is not closed. The flapping has its point of departure only at the orifice, which the current of blood has just passed; this sound has its point of departure, sometimes at the same orifice incompletely closed, but most generally at that by which the blood is escaping, incompletely opened. The seat of the first, then, is unique; that of the second may be double; (we only speak, here, be it understood, of one side of the heart). We may say here that the indications of the second may be less easy to gather, and less precise, at first sight, than those of the first. This morbid sound is the *souffle.*

The souffle, or bellows sound, includes all the valvular sounds, of which it remains for us to treat. A veritable stethoscopic Proteus, under the influence of such and such modification in the mobility of a valve, of the narrowness of an orifice, and, we may say, of the more or less happy inspiration of the observer, the souffle is changed here into the

sound of a rasp, there into that of a file or saw; at one time, soft and mellow, at another, rough and harsh; sometimes whistling like a young chicken, at others cooing like a pigeon, or yelping like a little dog. And let it not be supposed that these are mere flights of the imagination, or unnatural metaphors; they are, on the contrary, but the faithful translation of impressions really perceived, the true and positive interpretation of sound observation.

It must not be concluded from this, that the souffle is always a sign easy to seize, requiring but a slight attention, and striking at once the most unpractised ear; for, perhaps more than any other, this morbid sound offers different degrees and shades, almost indefinite. As to the most strongly marked of these souffles, the rasping sounds, and those resembling the cries of certain animals, without doubt these generally are easily recognized by the ear; but how tell whether they take place in the heart, or in its envelope, or in the pleura even, whose movements are not always so easily suspended as many may think? How can we know, in certain cases at least, to which of the two times corresponds the souffle? And if we may hesitate here, where at least the existence of the morbid sound is certain, how will it be for those light, rapid, transient souffles, which it is necessary to seize, as it were, on the wing, and to localize at once; which it is so easy to let escape, or confound with a pericardiac or pleural friction, and sometimes even, in a hasty examination, with the vesicular murmur?

We cannot, then, too much impress it upon the minds of those who wish to make of diseases of the heart an attentive and conscientious study, to accustom the ear to the sensation of the souffle; and, as has already been said, the best preparation is the frequent auscultation of the normal heart. In the second place, when the ear knows well what a souffle is, and the principal shades of which it is susceptible, it becomes necessary to recognize to what time it corresponds; if it is single

or double; if its duplicity is real, or only apparent; whether it is mingled, or not, with valvular flapping, or pericardiac or pleural friction, &c. Finally, which is not always easy to discover, it is necessary to determine to what point of the præcordial region the maximum of the souffle corresponds; is it heard most distinctly to the inside or outside of the breast? towards the point or base of the organ? towards the left edge and inferior hollow of the sternum? Is it propagated into the ascending aorta and the carotids? Each one of these indications has its different value and bearing in the diagnosis, as has been seen many a time, in our clinical analyses. Here, indeed, we should be liable to make frequent repetitions, if we did not confine ourselves within narrow limits, and recollect that we ought rather to sum up, than to develope, the practical considerations which this subject suggests. Let us, then, study the souffle briefly, at each time separately, and afterwards at both times.

1st. *Souffle at the first time.* — It must be confessed, that this is one of the most insufficient signs, in itself, that we have met with; for it may exist with, or without organic lesions. In the latter case, its cause may be simply the increased quickness of the column of blood; we have spoken of this with sufficient detail in the commencement of this work, not to return to it here; but its most frequent cause is a special alteration of the blood, *chlorosis, or chloro-anæmia.*

By what characters can the chlorotic souffle be recognized? By the following: like that produced by the increased quickness of the blood, this souffle *never exists but at the first time;* it is generally very *slight and short; it accompanies, rather than masks, the flapping of the first time; it is heard especially in the region of the aortic orifice, and very often only in this point; sometimes, in fact, it is propagated along the ascending aorta, and sometimes even into the carotids,* but in these cases, it is commonly stronger and less short than we have said; it may even be (we speak only of the

chlorotic, properly so called,) so prolonged, intense, and even rough, as to simulate a souffle of *organic* origin; finally, it is very often *inconstant and variable* in intensity, and even in its existence; a souffle, at one moment very distinct, the next becoming entirely inappreciable.

What is the determining cause of this souffle? Can we not find, in the characters which we have just assigned, some of the elements of this problem? This souffle is heard at its *maximum*, we have said, in the *region of the aortic orifice;* here is its precise anatomical seat. It exists at the *first time;* or at the moment when the column of blood passes this orifice. But, as has been seen, every kind of souffle supposes an *excess of friction;* upon what does this excess depend? *Evidently on an abnormal state of the column of blood, or of the aortic orifice. The state of the blood* first merits attention; for it is well known, that the important modification in the composition of this fluid constitutes the most essential element of chlorosis. Certain observers have stopped here, and said: "Natural philosophy teaches us that the friction of a liquid is in an inverse ratio to its density; a blood, then, which has become less dense, as the blood in chlorosis, ought to have more friction;" but they have not foreseen this objection, *that, if this were true, the friction, and consequently the souffle, ought to cease only when the blood has recovered its normal density; and that the blood does not change its composition from one moment to another, whereas the souffle in question is of an inconstancy and variability little compatible with this fixed chemical constitution.* There remains, then, the *aortic orifice;* shall we find here *possible conditions of narrowness and contraction, transient and variable?* Certainly; if we consider, on the one hand, that, in virtue doubtless of the old adage "Sanguis frenat nervos," chlorosis is an affection remarkable for an infinity of troubles and disorders essentially nervous;

and, on the other, that, by means of the ramifications of the great sympathetic, which are distributed to their parietes, there exists a most intimate connexion between the arteries and the nervous system, a very frequent cause of arterial disturbance purely local. Hence, the sudden heat of the countenance, the local redness, and the circumscribed beatings of the carotids, cœliac axis, &c.; hence, the anomalous arterial contractions, the spasmodic, semi-convulsive strictures, variable, like all the apparent external phenomena depending on nervous irregularity; producing here a "bruit de diable," and its numerous variations, and there a simple souffle; acoustic phenomena evidently in relation to the calibre of the vessels which are their seats, and whose different shades are dependent on the greater or less yielding of their tunics.

For us, then, *the chlorotic souffle is nothing but a spasmodic affection of the aorta. It is the "bruit de diable" of this large vessel, which generally does not exceed a souffle, but which may, in extreme chlorosis, (and we have seen an example) be carried even to a musical whistling;* this souffle tending to become whistling, generally, when an organic lesion and chlorosis coexist, a cause in itself of a permanent narrowness of the aortic orifice.

We insist thus at length upon this chlorotic souffle, because our observations, devoted to the study of the symptoms in organic diseases of the heart, have presented no opportunity heretofore of signalizing it; and because we could not pass over in silence a sign so nearly connected with this study, and which often is of great interest in a differential diagnosis. It is almost incredible of how many errors in diagnosis this souffle is the daily cause; how many anæmic females, or chlorotic girls, are treated for an imagined disease of the heart, by frequently repeated bleedings, chiefly because this fatal souffle has been heard; the treatment

of which thus becomes the best possible method of perpetuating it.[1]

To pass to the *souffle of the first time, with organic lesion.*

Contrary to the one we have just described, the organic souffle, at the first time, is usually more or less rude and prolonged; it may entirely replace the valvular flapping, either that this last does not exist, or that it cannot be distinguished from the souffle which masks it. As the preceding, it may exist at its maximum in the aortic region; but, unlike it, may also correspond to the bicuspid orifice; as the preceding, it may be propagated along the ascending aorta and the carotids; but, unlike it, does not vary from one moment to another, and does not cease to exist, after it has been once observed.

Does this souffle often exist, without that of the second time? In all our observations, we only find the 3d and 7th which have offered this single souffle. With what lesions does it chiefly exist? In the two cases just mentioned, it was with aortic lesions; valvular thickening in the one, cre-

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[1] To those who are familiar with the ideas of M. Bouillaud on the connection of rheumatism with the diseases of the heart, and his treatment of it by frequent and large bleedings, the following portion of the text may be interesting, as showing that his exclusive opinions are not universally admitted; as the reader is not interested in this defence of his master by M. Andry, we have omitted it in the body of the work. "This error may be easily imagined and accounted for, when it is known how little habit of auscultation many physicians carry with them to the practice of medicine. But what we cannot understand, and, we confess, is contrary to common sense, is, that some young authors have accused M. Bouillaud himself of this mistake, who has so many times loudly signalized this cause of error; seriously asserting that the pretended lesions of the heart, which, according to him, coincide with rheumatism, are only simple cases of anæmia; and that the souffle, from which he diagnosticates them, is a souffle of hydræmia, the result of the medical treatment to which the patient has been submitted."—*S. K.*

taceous state of the aorta in the other; as to this last lesion, it is oftener expressed by a souffle at the second time, or by a double souffle. It may be easily conceived, that a souffle of the first time only very rarely corresponds to an alteration of the bicuspid orifice; for what would be this alteration? An insufficiency; a lesion little compatible with the free play of this valve, at the other time, unless in the exceptional case of an insufficiency, from want of proportion between the normal valves and an increased orifice.

As we have often seen, then, the time, to which a souffle corresponds, by no means indicates the diseased orifice. In this case, we may say, empirically, that it will be most commonly the aortic orifice; besides, we shall be guided both by the seat of its maximum intensity, and by its propagation into the carotids; the absence of this propagation, and the difference of seat indicating a lesion of the bicuspid orifice. This aortic lesion will always be a contraction, absolute or relative; this last will coincide, for instance, with general hypertrophy, or dilatation of the left ventricle; the first will be caused, by a thickening of the valves, by a cretaceous deposit on their surface, by vegetations on their free edge, and by concretions between their folds. It is sometimes possible to indicate exactly the organic lesions just mentioned. Sometimes, for instance, the narrowness, the acuteness of the souffle gives, in a degree, the measure of the contraction; when chlorosis coexists, we have seen that the souffle may become sibilant; in all these cases of extreme narrowness, the pulse assists the diagnosis by its smallness and feebleness. If there are vegetations, or cretaceous matter on the valves, the souffle will be less pure in its character, rougher, more rasping, accompanied often by a vibratory thrill, which has frequently led to a diagnosis which we have seen confirmed by the autopsy. If there are merely coagula (it is rare that these coagula are localized at the aortic orifice only), the suddenness of the souffle, its variations, the

palpitations and dyspnœa, the character of the pulse, the coldness of the extremities, &c., may lead to the diagnosis of this morbid peculiarity.

We have said above that a souffle, limited to the first time, is somewhat rare; this remark, incontestable, we think, in old organic lesions of the heart, is less so in commencing lesions, in those which we see coming on in the course of any acute disease, of rheumatism most frequently. Often, in fact, we have been warned of the imminence of the danger by a souffle, still slight, and existing only at the first time. How can we distinguish this inflammatory souffle, this veritable sign of endocarditis, from the souffle of chlorosis? To a practised ear, this souffle has, in the first place, very often a peculiar character, which does not allow it to be mistaken. Besides, shall we suppose anæmia or chlorosis, if the patient has not been bled, or scarcely; if the blood drawn is rich, evidently inflammatory; if it marks more than 5 degrees by the areometer[1] of Baumé, above which limit the anæmic souffle is not produced, from experiments made in the wards of M. Bouillaud; if this souffle diminishes, instead of increasing, under the influence of bleeding; if, finally, the patient's face is highly and generally colored, his pulse vigorous and developed, the impulse of his heart strong (circumstances little compatible with a state of chloro-anæmia, and the production of a hydræmic souffle); if, in addition, we find the præcordial dulness increased in extent, the point of the heart displaced, &c.? Yet in such cases, it has been pretended that M. Bouillaud has mistaken anæmia for endocarditis!

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[1] Areometer (from ἀραιος, light, and μετρον, measure), an instrument for measuring the density of liquids. The instrument of Baumé consists of a cylindrical glass tube, terminated by a ball charged with mercury; being plunged into a liquid, it measures its density, or specific gravity, by the weight of the volume of liquid displaced. For Tables showing the relations between different instruments, see the U. S. Dispensatory.— *S. K.*

But is the distinction between these two souffles of the first time always so well marked? Certainly not; there are difficult cases: but what are these cases? They are, when an individual, copiously bled before our examination, or debilitated by a lingering disease, presents, at the same time, the paleness of anæmia and the acuteness of a relapse of rheumatism, inflammation of the chest, &c.; when any of these acute diseases develops itself in a young chlorotic female; in these cases, but only in these, there may be hesitation, at first, as to the nature of the souffle; long practice and profound clinical experience can alone determine this point of the diagnosis.

One word more before finishing this long paragraph. A souffle may be in reality single, only produced at one time, (the first, for example), and yet appear double; if it is loud enough to mask the flapping isochronous with it, and so frequently repeated that the ear cannot perceive the time which succeeds it. We have seen that the way to distinguish this apparent from a real duplicity, is simply to auscult beyond the præcordial region; a souffle being propagated less far than a valvular flapping, we can readily so weaken it by distance, if it be single, that the latter will be disengaged.

2. *Souffle at the second time.* — If we may hesitate as to the existence of an organic affection of the heart, simply because a souffle is perceived at the first time, the same uncertainty does not exist with regard to that of the second time; there is always here a valvular lesion, an obstacle to the free play of the valves. This simplifies, to a considerable extent, the history of this morbid sound, which is, in a manner, sketched in what has been said of the preceding souffle. Who does not see at once, that, here also, the cause of the souffle may be, either the narrowness of an orifice incompletely opened, or the insufficiency of a valve incompletely closed? It is then true, here also, that the time, to which the souffle corresponds, does not indicate the diseased orifice; adding, how-

ever, as the other souffle has suggested, that, the insufficiency of a valve being little compatible with the integrity of the other time which the unity of the souffle supposes, (except in the case mentioned of disproportion between the valves and the dilated orifice,) a souffle of the second time rather indicates a narrowness of the bicuspid orifice, than insufficiency of the aortic valves; always verifying this probability by determining the anatomical seat of the souffle, and its non-propagation into the carotids. It is unnecessary to enumerate the particular valvular lesions, which this souffle supposes, as it would be a mere repetition of the corresponding part of the preceding paragraph, with a simple transposition of the orifices.

Moreover, as now considered, that is to say, alone, the souffle of the second time is perhaps more rare, than that of the first. We have not found it, free from all mixture, in any of our observations; we may indicate, however, as examples of this souffle, if not single as to the two times, at least single as to the play of the same valve, the 6th observation, where it seems to have been produced by the cretaceous state of the aorta; and the 17th, where the souffle, single in the region of the bicuspid orifice, evidently corresponded with narrowness of this orifice, without trace of insufficiency. We find even, in this last case, the sharp character of the souffle signalized, which we have said is an almost sure index of the degree of contraction.

With the exception of the sibilant souffle of chlorosis, all the other shades of the first souffle may be reproduced in this, and diagnosticated in the same manner. We shall not, then, speak further on this point, nor insist upon the apparent duplicity which this souffle may present; all that has been said of the preceding being exactly applicable to this.

3. *Souffle at both times.* — After having successively studied the souffles of the first and second times, we can certainly easily understand how a double souffle may result

from the succession of these two, each one, for instance, coinciding with the corresponding flapping, which is only more or less completely masked; for the history of this fact, we have only to refer to the preceding paragraphs. But, if this case be possible; if we may, for example, have a simultaneous narrowness of the two orifices, without insufficiency of either; or double insufficiency, without narrowness; this is not commonly the case. We appeal to our 21 observations; one only, perhaps, (the 10th) will give us an idea of this pathological anomaly. Far more frequently, the two souffles have their cause, either in a double lesion of one or both orifices, or a double lesion of one accompanied by a single lesion of the other. To explain by a few examples, which our observations will furnish in abundance, as the double souffle is very common in organic affections of the heart.

If a single valve be, at the same time, so thick as to cause a certain contraction of the corresponding orifice, and so deformed as to close but imperfectly; shall we not have, in succession, the souffle of narrowness and that of insufficiency? this is shown by the 2d observation. It will be the same, if the valves, adherent to each other, (observations 13 and 17), or partially to the neighboring wall of the heart (observations 13 and 15) offer, thus, both a narrow passage unfavorable to the arrival of the blood, and an opening too favorable for its reflux.

If, while one of the two valves presents this double condition of souffle, the other is, at the same time affected, but only so as to offer one of the two morbid conditions just mentioned; we shall have a double souffle, the more distinctly marked as we approach the orifice principally affected.—See observation 14.

For still stronger reasons, there will be a double souffle, when there is a double lesion at each orifice; the 16th observation furnishes a good example.

Coagula in the heart may also powerfully concur in the

production of a double souffle, either combining their influence with that of existing valvular lesions, or constituting of themselves the principal cause of the obstruction of the valvular play. The cause of the double souffle, too, often exists without the limits of the heart, in the cretaceous state of the internal membrane of the aorta; in our observations we have too often insisted upon this pathological fact, and the means of diagnosticating it, to enter into any details here; see observation 8, among others. Finally, there is a possible, but exceptional, cause of the double souffle, an abnormal communication between the right and left cavities of the heart; this is so rare, that we merely mention it from recollection.

Such are the principal circumstances, anatomical and semeiological, which belong to the history of the souffle; one thing only is wanting to complete the picture. We have seen, in the commencement, that a souffle is possible without organic lesion; it remains to be said now, that organic lesions, the same as we have enumerated, have been known to exist without souffle. How can this be reconciled with the preceding facts? does it not call in question the validity of our theories? No; this is but a seeming difficulty. What is the physical, material condition of every souffle? an excess of friction. But, for the production of this result, who does not see that there is necessary, at the same time, both a certain obstacle to the passage of the blood, and a certain quickness in its course? Is it strange, then, that if sometimes the excess of quickness produces a souffle, in the absence of organic lesions, in other cases, the insufficiency of this quickness has for result the absence of souffle, even though these lesions exist? One is as frequent, and as easily understood as the other; and we have often noticed this at the bedside; we remember, particularly, a patient, whose pulse became exceedingly slow, under the influence of digitalis; we often perceived the disappearance and return

of a souffle at the second time coincide with the administration and the suppression of this medicine.

Is it necessary to speak apart of the sounds of the rasp, the file, the saw, and the cries of animals? These, and all other analogous sounds which may be introduced into our vocabulary, will always be mere shades of the souffle, in relation to the degree of valvular induration, or narrowness of the orifices. This is the only especial point in their history; and to enter into more details would be a useless repetition.

After having gone through the details of this vast whole, it is impossible not to acknowledge the value of this morbid sound, and its predominance as a symptom. We can understand, that, if other sounds can reveal to us an organic affection of the heart, this alone can penetrate its obscurity, indicate the diseased orifice, and determine the lesion; that to this, without doubt, belongs the greatest part of our success in diagnosis. Yet, there are practitioners, so behind the age as to treat as mere chimeras the legitimate pretensions of art in this respect, and obstinately to maintain that every thing is still to be done in the determination of the special seats of diseases of the heart. This blind skepticism is base ingratitude to the spirit of the age; we would heartily thank it, for having furnished us with a means of exploration, which may be compared with the most precise methods of surgery itself. Let us, then, honor and respect those of our predecessors and contemporaries, who have given to science this great inheritance; and continually endeavor to increase the treasure which has been bequeathed to us.

This leads us to confess, that in our clinical researches, there exists a blank, empty space, the more to be regretted that it is difficult to believe that it will ever be properly filled; we mean the precise diagnosis of affections of the right cavities of the heart. It is said that, these affections being infinitely more rare than those of the left cavities, their diagnosis may be generally neglected, without risk of great error, as

lesions quite exceptional. But, independently of the scientific impropriety of this designed omission, it may be remarked, that, although, in our observations, these are rare as primitive and capital lesions, they are none the less common as secondary ; and, that to neglect their study, is to throw aside, knowingly, an element of the diagnostic problem, often meriting the strict attention of the observer.

This inferiority of the history of the symptoms of the right cavities depends, doubtless, on several causes. Because, in the first place, these affections are less common, and therefore less known ; because the right cavities, being as it were more central, and their contractions being less strong than those of the left, their valvular sounds ought to be perhaps more distant and less well marked ; and because, their disorders always coexisting with graver disorders of the left cavities, the morbid results of the latter might easily mask those of the former.

These practical difficulties, although great, are not insurmountable ; in our clinical observations, the attempts at diagnosis, in this respect, have not been wholly unsuccessful. Let us briefly indicate the actual state of science on this subject.

It has been said : divide the præcordial region by an imaginary vertical line ; the morbid sounds, which predominate to the right of this line, between it and the sternum, will belong to the right cavities, those predominating to the other side will belong to the left. This mode of exploration is far from being infallible. Whether it be worthy of trust when the sounds are normal, or when the sounds of the right cavities only are modified or replaced, we can neither assert nor deny ; but we can affirm, with an assurance founded upon numerous observations, that, when the left valvular sounds are greatly altered, they monopolize, as it were, the ear, and exclusively take up the attention, whether to one side, or the other of the line indicated. We may refer, however, as

regards this, to observations 13 and 14, in which a souffle was noticed towards the inferior hollow of the sternum, and a lesion of the tricuspid orifice was found at the autopsy ; but also, we may oppose to these the 15th observation, where a lesion, absolutely analogous, coincided with the complete absence of this special souffle.

The little reliance, then, to be placed upon this sign, leads us to seek, in others, indications more constant and trustworthy ; these other signs are all the results, more or less immediate, of the functional troubles determined by the valvular alterations of the right cavities. These troubles affect, principally, the two grand functions of *respiration and the venous circulation.*

If we could be present at the very commencement, and follow all the symptomatic phases of an organic disease of the right side of the heart, we do not doubt that the first disorders would be furnished by the respiratory apparatus, and afterwards by the consequences, more or less general, of the stagnation of the venous blood. But this is not commonly the case ; and as these lesions are consecutive, sometimes final, so also the symptoms, which they occasion, show themselves only at a more or less advanced period of the disease, and sometimes during the last days of life.

What is here said of the right cavities must not cause us to lose sight of the relation, still more intimate perhaps, which exists between the lungs and the left cavities. These last, receiving directly the blood sent by the lungs, cannot be ever so little obstructed, without the stagnation of the arterial blood being immediately communicated, by degrees, even to the parenchyma of the lungs. The right cavities, on the contrary, sending the blood to the lungs, if this passage be ever so little suspended, the venous stagnation will arrive at the pulmonary parenchyma only by the interposition of the superior vena cava, into which the vessels, which have supplied the lungs, empty ; and perhaps also, from the suspension of

the "vis a tergo," which, under the influence of the right ventricle, the column of venous blood exercises on the movement of that which had previously arrived in the substance of the pulmonary tissue.

In fine, then, on the part of the respiratory functions, we have not direct disorders, if we may express ourselves thus, except in the case of considerable hypertrophy of the ventricle, and when its influence is not neutralized by certain valvular conditions, either breaking the current of blood, (narrowness of the pulmonary orifice,) or turning it from its course, (tricuspid insufficiency.) These disorders are, in the lungs, effusions of blood more or less extensive, hæmoptisis only, or even apoplexy; sometimes, on the contrary, and most commonly, there is cough, dyspnœa on the slightest exercise, but the lung is no more infiltrated with blood; it is gorged with an abundant serous fluid, which accumulates wherever the venous blood has not a free course; it becomes œdematous. Then also, soon supervene other analogous results, from the same cause; thus, the violet tint of the lips, the puffy swelling of the face; the infiltration of the extremities, which often opens the scene, gradually progressing from below upwards, affecting the legs, thighs, and abdominal parietes, complicated also with ascites. Then, the jugulars are distended; and the venous pulse is noticed, this almost infallible sign of the retrograde movement of the blood through an imperfectly closed tricuspid orifice. We repeat, that, for those who can follow the development of these different symptoms, added to those which indicate an organic affection of the heart, as præcordial prominence, displacement of the apex, increased extent of dulness, &c., the diagnosis of a lesion of the right cavities cannot be doubtful; and in many of our observations, these signs have led to the diagnosis of such lesions, as has been proved by the autopsy.

These signs are all the mere results of functional trouble, effects more or less distant from the anatomical seat of the

morbid cause. Can these signs, then, always indirect, be compared to those immediately produced by the lesion itself, and having, if we may say so, the same anatomical seat? in a word, to the morbid sounds inherent to the play, more or less deranged, of a diseased valve? And yet, before the discovery of auscultation, these were the signs "par excellence." These were the characteristic, pathognomonic symptoms of diseases of the heart in general, in the school of Corvisart; and many of them constituted what this great observer called the "facies propria" of the disease, adding that this "facies" was the physician's surest guide: signs little trustworthy, however, in this extensive signification, as they are, if not exclusively, at least principally, connected with the affections of the right cavities, affections in general secondary; and, even in these, only appearing at an epoch more or less distant from their commencement. They may even be wanting in some cases; witness the 17th observation, where the notable dilatation of the tricuspid orifice and right auricle was accompanied by none of these signs.

This digression, perhaps too long, but which required a place in the study of the symptoms of the heart's lesions, has caused us, for a time, to lose sight of the order of our categories; to return, then, to the last division of the sounds of the heart.

6*th Division.* — *Accompanied sounds.*

Whatever may be the character of the heart's sounds, whatever the modifications they present, in whatever manner they are replaced, other sounds may at the same time be observed, belonging either to the heart itself or to the pericardium. We shall now pass in review these accessory sounds, adding that they most frequently coexist with one or more of those before mentioned; they may all be considered, in the last analysis, as an exaggeration of the normal phenomena.

To speak, first, of the heart itself; normally, its point, in

striking against the walls of the thorax, produces no perceptible sound, or one which cannot be distinguished from the valvular flapping isochronous with it; but if this percussion be exaggerated, either in quickness, or from the volume of the organ, two peculiar sounds may strike the ear. Sometimes it will be a clear tinkling sound, silvery or metallic, named auriculo-metallic; not to indicate, as has been often supposed, that the auricle concurs in its production, but to distinguish it from the metallic tinkling of the lungs, or because it almost always requires for its perception the immediate application of the ear. This sound is easily imitated by percussing slightly the back of the hand, applied over the ear; this experiment, while it shows its mechanism, shows at the same time its little value as a symptom. What does it indicate, in effect? That the apex of the heart strikes against the walls of the thorax, which are thin, and not of a nature to deaden the vibration, by quick, or distinctly separate blows. Experience has proved, that if this phenomenon may take place in hypertrophy of the heart, it is equally possible in the absence of this, or any other lesion; it is, then, an accompaniment of but little interest, in a practical point of view. We may add, to complete its history, that it is generally heard only in the systole of the heart; sometimes, but very rarely, it is double; then, it must be supposed that the base of the heart undergoes a movement equal to that of the apex.

If the auriculo-metallic tinkling is compatible with the normal state, this is not the case with a sound of which we are now to speak; we may say, characteristic of hypertrophy, of which it indicates not only the existence, but, in a measure, the degree. This is a sound of a heavy, dull shock, the impression of which, often accompanied by an abnormal impulse sensible to the eye, announces, by its tone and peculiar characters, the hypertrophied, dull, rounded point of the organ. There is something pathognomic in this sensa-

tion, which enables it often to be easily distinguished amidst the loudest souffles by which it may be accompanied.

The pericardium is normally the seat of a serous exudation, lubricating its surfaces, which diminishes and facilitates their friction, so that the ear can perceive no sound. But if this liquid be suppressed or condensed, if the alternate motions of the two surfaces in contact become difficult, if these become rough, unequal, obstructed by adhesions, or confined by false membranes, there will result necessarily new sounds, of a character depending on the nature of their anatomical cause; here, a simple rustling or rubbing, like that of silk; there, a rasping or scraping, more or less rough; or a sound of new leather, resembling the friction sound of the pleura. All these are evidently but varieties of the friction sound; they constitute the last morbid accompaniment, which we shall mention; not, however, always at first easily perceived.

The pericardiac sounds are heard usually at both times, but especially at the first; they are superficial, nearer to the ear than those of the heart itself; and sometimes accompanied by certain general or local phenomena of pericarditis. Among the first, we may mention fever, anxiety, agitation, &c.; among the second, palpitations, the irregularities of the heart, and, under the hand, a certain sensation of friction, or obstruction in the movements of the organ; these have been noted in our 13th, 14th, and 18th observations. Sometimes very loud, they may mask the valvular sounds, both normal and abnormal; at others, when there is simple rustling, they may escape the most attentive ear, and embarrass the most practised observer, by simulating a souffle. In this last case it has been said that the souffle depends on a coexisting endocarditis; but we have some facts which lead us to believe, that, abstraction made of this complication, a false membrane may of itself give rise to a sound analogous to, if not identical with, a souffle; more superficial, doubt-

less, better circumscribed, and propagated to a less distance, but only to be distinguished by a most experienced observer.

The morbid sounds, the history of which we have just given, the last signs which belong to auscultation, terminate also the list of the different means of exploration applicable to the diagnosis of diseases of the heart. These, as we have seen, are sufficiently numerous; the most important being, certainly, those furnished by auscultation, we have comprised them, to facilitate their study and recollection, in a compact, tabular form; we refer, then, the reader to this, as a brief summary of the foregoing remarks.[1]

If now we glance at the various indications furnished by the stethoscopic and other signs, must we not confess, that, of our principal external or internal organs, there is not one whose diseases are revealed to us by such numerous or precise signs; that the heart is, at present, one of the organs whose diagnosis is the most positive and complete? This conclusion may seem very rash and presumptuous to some; and it is one that we should not have ventured to set forth so explicitly in the commencement of this work, but which now we express with assurance, persuaded that no one of our readers will think it unfounded.

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[1] We have added this table of M. Andry, for convenience of reference, in the Appendix; which see. — *S. K.*

END OF PART SECOND.

PART III.

PRACTICAL APPLICATIONS OF THE DIAGNOSIS OF DISEASES OF THE HEART TO THEIR TREATMENT.

If the success in the diagnosis of our clinical cases is well calculated to satisfy the observing lover of his art, an objection none the less exists against the practical value of these researches; an objection painful to the friend of the human race, and which we have heard too often repeated to be astonished if it should now present itself to the reader's mind. This objection is, that the organic affections of the heart are, and always will be beyond the resources of medicine; to what purpose this superfluous precision of analysis in incurable diseases? to what purpose the diagnosis of what you so badly treat? what imports it to your palliative treatment to know the anatomical seat, or even the kind and degree of the lesion?

If all the diseases of the heart presented to us these grave deformations of the valves and orifices, which we have seen characterized by the double souffle, the vibratory thrill, anasarca, &c., we should not attempt to deny the truth of this objection; certainly, in cases of this nature, the local diagnosis is of little importance, when the general diagnosis, if we may use the expression, is so easy; when, also, the cure is evidently impossible. But how far is it from the truth, that all the cases of diseases of the heart are identical, in this

respect? Have we not just seen, when on the subject of pericarditis, of how many difficulties its diagnosis is often susceptible? Will it be said, that pericarditis is one of these affections, in which the physician can excuse his deficient diagnosis on the plea of its incurability? But to speak only of the heart itself, (although pericarditis is certainly intimately connected with its history, were it only as regards the differential diagnosis,) is it, then, true, that to all the lesions of this organ equally and indiscriminately applies this terrible decree of Corvisart: "Hæret lateri lethalis arundo"? Have the sanguineous concretions been forgotten, of which we have spoken in our last observations? It is true, that, in almost all these cases, we have seen a fatal termination; but does it thence follow, that this must always be the case? Can a proper treatment never triumph over these foreign bodies? To show the error of such a conclusion, we refer to our 20th observation; besides, this practical fact is of sufficient importance to be impressed upon the mind by two observations, which we shall here introduce, and which will complete the clinical history of this morbid product.

Observation 22d. — *Temporary coagula, in a patient affected with an organic disease of the heart and emphysema.* A man, 70 years old, of a constitution strong but deteriorated by age, was brought to the hospital on a litter, the 17th of May, 1840. Suffering from great dyspnœa, which had come on some days before, he could answer our questions only in an interrupted manner, and with difficulty; he said that he had always enjoyed good health; he complained of only a slight weakness of the legs for the past year, and a feeling of heaviness or numbness since 6 months; he experienced also some oppression after ascending, and palpitations. These attacks of suffocation had so increased since three or four days as to induce him to enter the hospital.

Present condition. — Face slightly pale; the lips violet, as well as the hands, which are also cold; the jugulars are

dilated, especially during expiration : no œdema of the lower extremities.

The inspirations rapid, not deep, difficult, are 36 to 40 in a minute. The resonance is good over the whole chest : but, on each side of the vertebral column, there is a slight prominence ; the respiration is accompanied in front, and particularly behind, by a mixture of sibilant and crepitant râles.

The pulse is 84, irregular, intermittent ; sometimes small, sometimes developed. No præcordial prominence ; the dulness is $4\frac{1}{3}$ inches square ; the apex is felt beating in the 5th intercostal space, but obscurely ; the impulse is moderately strong. The sounds, from time to time profound, dull, intermittent, are nevertheless, accompanied, almost continually, by a double souffle, very distinct in the præcordial region, propagated even beyond it, effacing the two flappings in the regions of the bicuspid and aortic orifices ; continued, in the aortic region, even to the upper part of the sternum, but here allowing to be distinguished the second flapping, which is dry and slightly parchment-like. In the carotids, the souffle of the first time is hardly perceptible. Nothing remarkable in the other organs.

We immediately prescribed a bleeding of 16 ounces, and warm applications to the lower extremities.

On the next morning, the patient's condition was about the same. The sounds of the heart the same ; the dyspnœa always considerable ; the speech interrupted ; the patient only breathing half seated in his bed.

M. Bouillaud ordered two blisters to the back of the chest.

The following days, the oppression diminished : the pulse became regular, fuller, and offering only a very few intermittences at long intervals ; it fell to 68 – 72 ; the respiration 20 in a minute, without evident râles. The souffle covered only the first sound, and was much less intense. The patient, finding himself quite well, demanded his exit on the 1st of June.

It is useless to comment at length on this observation. Who does not see, at once, that there were here all the signs of a moderate hypertrophy of the heart, with lesion of the left valves, and especially of the bicuspid? We shall not insist on this part of the diagnosis; but we maintain, that, independently of these permanent lesions, we had here *coagula temporarily arrested in the cavities of the heart; and it is by these that we explain this extreme dyspnœa, this anxiety, this coldness of the extremities, this dilatation of the jugulars, this intermittence and irregularity of the heart's contractions, this pulse, sometimes small, sometimes developed:* perhaps even, *these bronchial râles*, in regard to which we had also reasons for suspecting the existence of emphysema.

Such was our diagnosis: it was rendered still more probable, after the so manifest amelioration in the symptoms; after we had compared the souffle noticed during the last days with that which existed at his entrance, this difference seeming to us too great, by far, to be caused merely by the comparatively small difference between the 84 pulsations of the day of his entrance and the 72 of that of his exit. But, if there may be doubts as to this case, there can be none in the following, which seems to us above all question, in this point of view.

Observation 23d. — *General hypertrophy of the heart, with thickening of the valves. Triple sound. Coagula in the heart. Pulmonary œdema.*

Antoine Cambronne, aged 19, cabinet maker, was admitted the 13th of January, 1841. Of delicate constitution, and lymphatic temperament, he was attacked two years ago with palpitations and dyspnœa after an ascent, preceded, and apparently caused, by an acute, general, articular rheumatism, which lasted 2 months.

Symptoms on entrance. — No swelling of the face, nor infiltration of the extremities. The pulse 80, moderately de-

veloped, with rare intermittences and inequalities. Præcordial prominence of 2 or 3 degrees by the cyrtometer. The point of the heart raises the 6th intercostal space, with propagation to the inferior part of the sternum, where strong beatings are felt. The dulness is about 3 inches square; the impulse strong and extensive; no vibratory thrill. On auscultating the præcordial region, the ear is struck at first by the hardness of the two sounds, which are dry, parchment-like; distinct from each other, without well-marked morbid accompaniment. Still, the first is accompanied by a kind of rough, friction sound, which resembles a souffle, particularly towards the inferior part of the sternum. No souffle in the carotids. Cough rare; a few sero-mucous sputa; the resonance is every where good; the same is true of the respiration, which is accompanied, partially, to the left, and in almost the whole extent of the right back, with a humid, fine râle, heard only at the end of the inspiration, and resembling the crepitant.

The next day, M. Bouillaud observed the following signs: pulse 64, developed, vibrating, regular, not redoubled. The valvular sounds at the same time slightly dull, yet strong, without distinct souffle; but they are decomposed evidently into 3 sounds by the doubling of the second; this triple sound, well-marked in the whole præcordial region and its neighborhood, offers its maximum clearness above the breast. The same slightly humid crepitation; the chest is, generally, a little prominent behind, and very resonant; a few, glairy, semi-transparent sputa, without tinge of blood.

So far, nothing can be plainer than the diagnosis of this case; there is, without doubt, *general and considerable hypertrophy; also a fibro-cartilaginous thickening of the valves, without remarkable contraction of the orifices; and perhaps, a bronchitis with tendency to emphysema.*

Such was, at least, the diagnosis of M. Bouillaud, who prescribed, in consequence, a bleeding of 10 ounces; cupping

on the back, on both sides, to the same amount; pectoral tisans, and a potion with tincture of digitalis.

It should be remarked, apropos of this diagnosis, that M. Bouillaud did not, as usual, signalize the left valves as being specially affected. We do not know if the roughness of the first time, noticed towards the inferior part of the sternum, led him to suppose that the right cavities might participate in the disease; but we shall see him, farther on, indicate coagula in these cavities particularly. We confess that the lesion of the right valves seems to be a very probable coincidence; and we suspect that this lesion is not wholly indifferent in the production of the bronchial râles, which, on this hypothesis, would be rather a sign of œdema, the result of a slight obstruction to the cardio-pulmonary circulation, than a symptom of the bronchitis, with emphysema, admitted by M. Bouillaud.

As to the valvular lesion, the character of the sounds and the absence of souffle plainly indicate a considerable thickening of the valves, without deformation, vegetations, &c., and, as said M. Bouillaud, without notable contraction of the orifices. We may here observe, that there being in this case a triple sound, it may thus exist without the bicuspid contraction mentioned above. We may also add a last remark, in addition to those already made, in support of the assertion that the triple sound is only perceptible on the condition of a certain slowness of the pulse: absent at the patient's entrance, when the pulsations were 80, while there then existed, especially on the side of the right cavities, a rough friction at the first time, this triple sound became distinct the next day, when the pulse had fallen to 64, and the rough sound mentioned had disappeared. The phenomena noted the following days support this opinion, at least as regards the rasping sound; thus, on the 15th, the pulse being 72, the triple sound persisted, with a rough and rasping character; the following days, when the pulse had fallen to 56, the triple

sound existed perfectly distinct, without this peculiarity of tone. Besides, under the influence of the cupping-glasses, and a blister to the back of the chest, the crepitation entirely disappeared; and on the 20th, the patient felt himself well enough to sit up for several hours, without permission from us.

Here commences the part of the observation which particularly interests us. In consequence of this imprudence, the patient was seized with a considerable dyspnœa; and when we made the evening visit, we found him breathing with the greatest difficulty, the respiration anxious, 36 in a minute; face and trunk covered with profuse sweat; pulse 128, vibrating; the sounds of the heart strong, with a rude souffle at the first time; the resonance good over the whole chest, but we heard, on both sides, and even in front, a humid and abundant crepitation, with mixture of the sibilant râle in the left back, without pain in the side; expectoration purely mucous. We prescribed immediately a bleeding of 12℥, and sinapisms to the feet.

On the 21st, M. Bouillaud noted, at his morning visit: The relief from the bleeding only temporary; oppression and anxiety very great; sleeplessness; abundant sweats during the night; paleness of the countenance. The pulse 120, regular, vibrating, contrasts, by its little development, with the force of the heart's beatings. The sounds are sensibly more obscure, more masked on the right than the left; the first is a little rude, but without distinct souffle at present; the triple sound does not exist. The respiration 40; crepitation in the whole chest, with tendency to souffle behind, from the frequency and force of the respiratory movement; the resonance everywhere tolerably good; the sputa glairy. The coagulum of the evening's bleeding is firm and glutinous, without crust; the serosity slightly turbid. Bleeding of 8℥, and cupping on the chest of 10℥ was ordered.

The 22d, the patient was better. The dyspnœa and anx-

iety had disappeared; the pulse 84, developed; the sounds of the heart less strong and rude; the triple sound had not reappeared distinctly; the crepitation less abundant on the back, absent in front; the resonance good. The coagulum firm, glutinous, and covered with a thin crust; the coagula of the cupping-glasses of moderate resistance.

The 23d, improvement continued. The pulse 76 – 80. Return of the triple sound, but less marked than before. Still a little crepitation on the back.

The 24th, the same. The triple sound returned. Pulse 68.

The 29th, on the morning visit, we found the patient in a state of dyspnœa worse than ever; half-seated in his bed, he presented great agitation, with utterance of groans and cries; his face was discolored, covered with sweat, as well as the trunk; his lips violet; his eyes half-closed; his nostrils dilated. The respiration 48; the crepitation had reappeared in the whole chest; the pulse small, quick, 128–132. The sounds of the heart rough, without notable souffle; depending perhaps on the difficulty of analyzing them, from their excessive quickness; the triple sound had disappeared.

This attack commenced the evening before, the patient having eaten to excess food brought by his friends. We prescribed a bleeding of 8℥, and blisters to the inside of the thighs.

On the 30th, the same condition as in the evening, continuing, without interruption, during the whole day. The pulse almost imperceptible, 108 – 112; the heart beat with force against the hand; the sounds the same as before, but evidently masked. The respiration hurried; a fine, humid crepitation heard over the whole chest. The extremities cold; the patient agitated, and threatened with suffocation; he seemed doomed to certain death, and life was but a prolongation of his agony. Not daring to have recourse again to bleeding, we ordered two blisters to the back of the

chest, sinapisms to the feet, an infusion of linden flowers (tilleul), and an etherized potion.

The 31st, these accidents had ceased; patient in a horizontal position. The pulse 68 – 72, developed, full, regular; the sounds of the heart perfectly distinct; no longer masked, they contrasted singularly with those of the evening.

M. Bouillaud added to his diagnosis: *afterwards, phenomena of left capillary bronchitis, and disseminated pneumonia. Probably concretions in the heart, especially in the right cavities.*

We may say, to terminate this somewhat long history, of which the length will doubtless be pardoned from its interest, that the paroxysms of dyspnœa did not return; but that first an erysipelas of the right arm, then a rheumatismal swelling of the left knee and right wrist, kept the patient in the hospital until the 2d of May. During this time, the triple sound was frequently noted; and, on the 24th of February, was heard a souffle at the first time in the inferior hollow of the sternum, ceasing at a very little distance from this point. The 22d of April, this sternal souffle was accompanied by a very distinct whistling cry. On the 2d of May, the day of his exit, the souffle of the first time was still perceived, in the region of the right cavities, and very dry and parchment-like sounds in that of the left.

There is no necessity of entering into details upon this observation; it may be said to be a history of concretions in the heart. Besides (which is its not least interesting point), it is easy to see, that if coagula may be deposited in the heart before death, they may, also, by proper treatment, be removed or absorbed, often even with considerable quickness. Of what importance to the physician is this diagnostic point! It may be added, as to the symptomatic study of the lesions of the right cavities, to those mentioned above, in which the morbid sounds were heard particularly towards the inferior hollow of the sternum. It is also worthy of notice,

as regards the gradation presented, in constancy and tone, by this morbid sound, so well localized, and answering, according to us, to the orifice of the pulmonary artery; a gradation, in this case, increasing, and to which the sanguineous concretions might not have been stranger.

We confess we cannot account, as M. Bouillaud, for the humid, general crepitation, so quickly appearing and disappearing with each paroxysm, by a disseminated pneumonia, or even by a general capillary bronchitis, an affection always tenacious, and resisting the most energetic treatment. The characters of the expectoration, the absence of dulness, some similar observations verified by post-mortem examinations, led me to suppose rather an acute pulmonary œdema; a disease usually better known and more observed under a slow and chronic form, but, we think, none the less real; very rapid, too, in its march, able to compromise life in a few moments; but offering this advantage, that often dependent on a more or less sudden arrest of the venous circulation (as in this case), it may quickly disappear if the obstacle be removed.

This and the preceding observation show, then, the practical importance of being able to diagnosticate, and particularly to treat, these sanguineous concretions, grave and frequent epiphenomena of organic affections of the heart. But how much more important does it become, when we consider that these morbid products are equally possible in several other affections, as pneumonia, pleurisy, rheumatism, &c.; affections in which a daily examination of the heart can alone, often, give the key to certain febrile states which appear to outlast their primary cause, and in which, so frequently, the astonished observer, for want of a more precise diagnosis, has recourse to the often chimerical idea of a *diathesis!*

How much more necessary the exact appreciation of what passes in the heart, when it is added, that in all these diseases there is, instead of sanguineous concretions indicated

by evident physical signs, the complication of a commencing endocarditis, the origin of so many incurable lesions; and which then is revealed only by signs appreciable to the practised ear, an affection as difficult to diagnosticate at its commencement, as it is important to treat at this period of its development? We have at hand numerous observations, showing the coincidence between an affection of the heart and an inflammation. We have one under our eye at the present moment (the only one it is true), a case of typhoid fever, in the course of which an organic souffle announced a very unexpected complication. We cannot mention these cases here; still there is one which we will take as an example, as it offers the curious peculiarity of a disease of the heart commencing under our eyes, and, from the active treatment suggested by its diagnosis, disappearing without leaving traces of its existence.

Observation 24th.—*Acute articular rheumatism. Rasping souffle at the bicuspid orifice, a little after the patient's entrance. Chlorotic souffle on his exit.*

Edward Poplu, 23 years of age, hair-dresser, was admitted into our wards, the 25th of May, 1841. This young man, of moderately strong constitution, and lymphatico-sanguine temperament, was attacked a year ago with an articular rheumatism, general and febrile, which hindered all motion for the first seven or eight days, and which lasted six weeks. Treated at la Pitié by a bleeding, opiated cataplasms, and pills of opium, he left the hospital relieved, but still having pains in the fingers and toes. He has been since subject to vague pains on changes of the weather, and to palpitations. Six days ago, without known cause, he was seized with pain in the wrists, which soon became localized in the right, accompanied by a slight shivering and febrile heat.

Present condition. — The right wrist, as well as the hand, is of a diffused red color, evidently hotter than the opposite limb; it presents an evident tumefaction, expressed relatively

to the left wrist, by a difference of 3 lines. The subcutaneous veins of the affected side are the most prominent. The pain is almost continual, acute, increased by the least motion; the face is generally pale, thin, as well as the rest of the body. Nothing remarkable in the digestive, or respiratory apparatus; the heat of the trunk moderate, a little moist. The pulse 96–100, full and vibrating, especially in the right radial, where it is evidently more developed than in the left. No præcordial prominence; no displacement of the apex; no abnormal dulness; the impulse is very distinct, of moderate extent, without vibratory thrill; the sounds are regular, distinct, clearly separated, without souffle; no "bruit de diable" in the carotids.

We prescribed a bleeding of ℥12.

On the 26th, the patient felt relieved; had slept well. The hand and wrist were less red, and a little less swelled; a little spot of roseola towards the middle of the posterior face of the radio-carpian articulation; the veins still large. The pulse 84, tense, full, resistant, and evidently, as the evening before, most developed on the right side. The præcordial dulness normal: but, in the region of the left cavities, was heard a very distinct souffle at the first time, covering almost entirely the valvular flapping, slightly rough and sharp, perfectly distinct towards the bicuspid orifice, diminishing in intensity as the sternum was approached, and even almost entirely disappearing, towards the summit of the thorax, to be replaced by a distinct flapping. The flapping of the second time is, on the contrary, without souffle, and very distinct. No trace of a continued souffle in the carotids or subclavians, in which is heard, by propagation, a double flapping, the first of which is without notable souffle. No pain in the præcordial region. The clot of the bleeding presented only a thin crust: the serosity was slightly turbid.

The results of this second examination, as to the heart, were so different from that of the preceding evening, that we

ausculted again, before M. Bouillaud dictated the above. We had hardly applied the ear, when we heard the souffle at the first time, as has been described. We were so struck with its rudeness, that, unable to believe that it had only dated from the preceding evening, we attributed it immediately to the attack of rheumatism which the patient had had a year ago, and since which he had been subject to palpitations; presuming that it had escaped our attention in the evening. Still we had some objections to this supposition, when we remembered the care with which we had made the evening's examination; being decided, only after long researches, and a conviction of its absence, to deny the existence of a souffle, which so many reasons led us to admit and announce almost with assurance. Besides, let us see what became of this souffle.

M. Bouillaud, to treat properly the local rheumatic affection, the state of internal inflammation indicated by the fulness and vibration of the pulse, and the condition of the heart itself, recent perhaps, and manifested by the souffle, prescribed a bleeding of ℥12, and cupping to the wrist and hand of from 8 to 12 ounces.

The 27th, the patient was better: he moved much more easily his hand, the swelling and redness of which had diminished. He, however, felt some new pains about the shoulders, in the right arm, and in the fingers of the left hand. The heat of the skin very moderate; the pulse less tense, less full than in the evening, 72–76. Frequent auscultation could hardly detect, at the end of the first time, a few traces of the rasping souffle, which yesterday covered completely the flapping. The first sound, on the contrary, is distinct, and the difference between it now and in the evening extremely great. No continuous souffle in the carotids, or subclavians. The clot of the bleeding was strongly contracted, with a crust, slightly cupped, of moderate thickness; those of the cupping were united into a mass tolerably glutinous; the serosity was not reddened.

Can it be doubted that the souffle was of new formation, and the positive indication, either of a commencing endocarditis, having already thickened the bicuspid valve in a manner to hinder its closing, or of fibrinous concretions deposited upon its folds and producing the same result? We think not. For we should not have seen a morbid sound disappear so readily, unless it was of very recent formation; this success of treatment was also a powerful motive to continue it, even at the risk of impoverishing, for a time, the mass of blood. M. Bouillaud, therefore, did not hesitate to order a new bleeding of ʒ12, indicated moreover by the new pains, which, though vague, might well announce that the rheumatism was not yet extinct.

What proves this second indication to have been real is, that, on the 28th, the pain of the left shoulder was more acute; there was added, also, a slight sore throat, with a little swelling of the right tonsil, and redness of the mucous membrane of the pharynx. The clot was strongly contracted, with a thick and cupped crust. Still, the hand and wrist had returned to their normal state, the pulse was 68–72, and the first sound more disengaged.

This time, a relapse of the rheumatism was the only danger, but this was sufficient reason for M. Bouillaud to order a final bleeding of ʒ12.

The 29th, the patient was better; there was no pain, but a slight sore throat. The pulse 68; the first sound as distinct as the second, without mixture of notable souffle. The patient was allowed a meat soup.

The 30th, the amendment continued: the pulse 60. Nothing new as to the heart.

The 31st, the pulse was 60. There was heard a very slight, soft, chlorotic souffle, terminating the first sound, of which the flapping was very distinct. This souffle, propagated into the sub-sternal aorta, coincided with a well-marked "bruit de diable" in the left carotid. The patient was otherwise very well.

The 15th of June, he requested to go out, being cured. A very well-marked " bruit de diable " was heard in the left carotid, when the patient was seated only, and a distinct, chlorotic souffle, at the first time, towards the aortic orifice, whence it was propagated into the sub-sternal aorta. There was no sign of an organic lesion of the heart.

This observation is remarkable in many respects; each particular is worthy of interest, especially the chlorotic souffle at the end of the treatment, as if speaking in favor of the organic nature of the rasping souffle which had preceded it, and to answer once more those, who pretend that M. Bouillaud does not distinguish these souffles in his observations.

What we wish especially to observe here is, that M. Bouillaud, from having made a precise diagnosis, cured a commencing organic disease of the heart: that there are, then, cases, among these grave lesions, where our treatment is not simply palliative. But, without entering here, into the minute study of their causes, which would lead us too far from our subject, let us examine our 23 preceding observations, as to their probable cause. We find, in 7 cases, the cause unknown; twice, the cause was traumatic; 5 times, an inflammation of the chest, or an acute bronchitis; and 9 times, a rheumatism. We have, then, 16 cases out of 23, in which every thing leads to the belief that an endocarditis, doubtless passing unperceived, was the point of departure of these fatal disorders, which become afterwards the opprobrium of our art; and which, then commencing, might, perhaps, have been cured, if it had been known how to discover and treat them.

These practical considerations fully sanction all that our diagnostic studies may appear to offer of scientific luxury, and, we may almost say, of exaggerated pretension. Every one will see of what assistance, nay of what necessity, must be, in a case like the preceding, the habit of these special examinations, of these minute analyses of the most complex cases, of which we have indicated the means and the results.

In thus exercising ourselves in the diagnosis of diseases of the heart, whatever may be the obscurity of their symptoms; in studying to discover these affections when they exist, we at the same time enable ourselves to indicate the cases in which they do not exist, whatever may be the functional troubles which seem to announce their existence. In many cases, this negative diagnosis requires, at least, as much practice as an affirmative one. We speak here of nervous palpitations, and particularly of chlorosis, a disease insidious in its symptoms, and which, among others, often takes on, in the eyes of inexperienced observers, the appearance of an organic disease of the heart. We may mention here a distinguished druggist of Paris, who believing himself affected with an organic lesion of the heart, on the word of a physician, referred to this cause frequent palpitations, pains in the præcordial region and elsewhere, paroxysms of dyspnœa, &c.; and in whom all these symptoms have disappeared, for two years without return, because we advised him to use only antispasmodics, or rather because we were so fortunate as to make him understand that his organic lesion was merely imagined. We may also mention one of our chlorotic patients, who came to Paris expressly to be treated for a supposed hypertrophy of the heart, against which the principal physicians of one of our northern cities had employed in vain every antiphlogistic measure, and all the combinations of digitalis.

We could mention a great number of analogous facts; we do not exaggerate, when we say that, during our two years of service, a week did not pass, in which we did not receive into the wards several of these unfortunate victims of mistaken diagnosis. If, most frequently, simple cases of chlorosis were sent to us as affections of the heart, sometimes also, from an opposite mistake, we have had, what is more astonishing, veritable organic diseases of the heart, already far advanced, sent to us as cases of chlorosis.

And it is when such errors are daily happening; when iron is given in cases which require bleeding and digitalis; when, on the contrary, bleeding is employed where it is necessary to remake the blood; that it is demanded of us, of what use are our precise studies and minute researches upon questions so fruitful in errors, not less shameful for the physician than prejudicial to the patient! And the very individuals who are thus misled, come forward and reproach us with wishing to throw an excess of light, a superfluous clearness, upon the path along which they blindly grope!

We think we have reduced this objection to its just value.

We trust we have sufficiently shown, that, if before certain organic lesions of the heart we are, and ever shall be, powerless, it is incontestable that, these sad truths apart, there is many a therapeutic palm to gain, many a practical success to attain; and that this subject will sufficiently repay any trouble and study it may cost us. We shall be happy, if, in this memoir, we have shed any light upon questions eminently clinical, and have stimulated the zeal of young physicians for diagnostic studies, which we consider one of the brightest portions of our art.

END OF PART THIRD.

APPENDIX.

SYNOPTIC TABLE OF THE SOUNDS OF THE HEART.

(*After the Treatise of M. Bouillaud, by Dr. Felix Andry.*)

Sounds of the heart.

- **Normal.** Tic-tac, or two sounds, the first of which is a little the dullest and longest, isochronous with the pulse, and consequently with the ventricular contraction; the second the clearest and shortest; between the two a very short silence; and after the second a longer silence. The first is heard at its maximum below and a little to the outside of the breast (left auriculo-ventricular orifice); the second, above and to the inside of the breast (aortic orifice). (1)
- **Increased.**
  - Clearer. — No very precise clinical indication. Thinness of the walls. Dilatation of the cavities. Emaciation. Stomach distended by gas.
  - Stronger. — Hypertrophy of the heart. (2) Circulation increased in quickness, from any cause.
- **Diminished.**
  - Less clear (dull. / hoarse.) / Less strong (hoarse. / veiled.) — Commencing endocarditis. Coagula in the heart. Walls thickened, and cavities narrower. Hydropericardium. Atrophy of the heart. Embonpoint. Interposition of a portion of lung. Semi-syncope.
  - Null. — Considerable hydropericardium. State of Syncope.
- **Modified.**
  - In their seat. — Displacements of the heart, congenital or acquired.
  - In their tone (dry). — Thickening of the valves, without deformation.
  - In their rhythm (intermittent, irregular). — Nervous palpitations. Often organic lesion, but then other signs. (3)
  - In their number. (3 or 4 instead of 2). — Lesion of the left orifices, especially the bicuspid. Sometimes hypertrophy of the left auricle. (4)

- Sounds of the heart.
  - Replaced by
    - Souffle.
      - At the 1st time. — (Slight, limited to the aortic orifice) chlorosis. (5) (Rougher, more extensive) valvular lesions. Coagula. Congenital narrowness (or acquired) of the aortic orifice, the sigmoid valves being healthy; which generally coincides with hypertrophy or dilatation of the left ventricle. The souffle is then sharp.
      - At the 2d time. — Valvular lesions. Coagula. Abnormal communication between the right and left cavities. Adhesion of the valves to the neighboring wall of the heart. Dilatation of an orifice, for which the valves then become insufficient. (6, 7, 8)
      - At both times. — (same as above)
    - Sound of the rasp, file, saw, cry of animals, snapping, &c. — Organic lesion of the valves, or orifices. (9, 10)
  - Accomp'd by
    - Auriculo-metallic tinkling. (11) — Sometimes hypertrophy. Acceleration of the beatings.
    - Rustling, or friction. / Rasping. / Sound of new leather. — Pericarditis, with false membranes more or less rough, adherent, &c. (12)

NOTES TO THE TABLE.

(1.) There are four causes in the production of these sounds: 1st, the shock of the heart against the walls of the thorax; 2d, its sliding on the pericardium; 3d, the passage of the blood through the cavities; 4th, the closing of the valves. This last predominates so as to neutralize the three others. Even in hypertrophy, the first is a shock which does not prevent the valvular flapping from being heard. This percussion of the apex is felt normally at about 1 3-5 inches below the breast, and a little to the inside, in the 5th intercostal space. The præcordial dulness is from 1 1-2 to 2 2-5 inches square.

(2.) Considerable hypertrophy without valvular lesions is very rare.

(3.) The intermittence, in nervous diseases, is in general more or less regular, unless in the case of vivid emotions; in the organic lesions of the heart, it is usually irregular. The intermittence is either true, when the systole has ceased, or false, when the systole is only more feeble; the arterial pulse is wanting in both cases. There is sometimes a "faux pas" of the heart, when the ventricle, incompletely filled from contraction of the auriculo-ventricular orifice, contracts almost empty; sometimes there is irregularity, when the beatings are unequal among themselves in force and interval; sometimes for one systole there are two or even three diastoles, and vice versâ.

(4.) The triple sound is explained by supposing that the ventricle contracts twice on the column of blood incompletely expelled; or that perhaps the hypertrophied auricle contracts with sufficient force for the column of blood to produce a sound in traversing the auriculo-ventricular orifice; or, finally, that there is derangement in the synchronism of the four sounds, which normally are only heard by twos. These hypotheses are also applicable to the quadruple sound.

(5.) This souffle is explained, to a certain degree, by the friction of the column of blood against the aortic orifice, this friction being in the inverse ratio of its density; or rather by a kind of spasm of the aorta. This chlorotic souffle accompanies often, rather than replaces, the valvular sound. In extreme chlorosis there is sometimes a musical whistling in the heart. When there is coexistence of chlorosis and organic lesion, the souffle tends to become sibilant.

(6.) To whatever time the souffle may correspond, how distinguish the diseased orifice? By the seat of its maximum intensity, either to the right of the breast (aortic orifice), or to the left (auriculo-ventricular orifice); and by the auscultation of the carotids, in which the propagation of the souffle is sometimes distinct (aortic lesion), and sometimes null (auriculo-ventricular lesion).

(7.) The lesions of the right cavities are much more rare than those of the left; those of the aortic orifice more rare than those of the auriculo-ventricular, except in old persons, in whom other arteries are diseased at the same time.

(8.) When a souffle, or other abnormal sound, is heard at both times, this duplicity is either real, or only apparent, according as two orifices are diseased, or only one; the distinction is made by withdrawing the ear beyond the præcordial region.

(9.) These abnormal sounds, like the souffles, suppose an excess of friction, and consequently an issue of the blood more rapidly than normally. There may then be, — 1st, Souffle (at the first time) without organic lesion, if the circulation is very rapid; 2d, organic lesion without souffle, or abnormal sound, if the circulation is very slow.

(10.) The organic lesions are also characterized by other signs; as swelling, increased dulness, displaced apex, extensive beatings, vibratory thrill (there are cases, hitherto inexplicable, of this thrill without organic lesion), dilated jugulars, swelled extremities, &c.

(11.) It is generally only heard in the systole; sometimes, however, but very rarely, it is double. This is of little value as a sign, when it exists alone.

(12.) These three varieties of the pericardiac friction are generally heard at both times, but especially at the first. They are sometimes so strong as to mask the valvular sounds, or even the abnormal sounds of the heart. Most frequently they are easily distinguished, because they are more superficial, and nearer the ear. It has been said that the souffle is possible in pericarditis; but it has not been proved that this sign can exist in simple pericarditis.